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CONCUSSION RISK IN TOP LEVEL KARATE COMPETITION

Sports involving contact are often associated with an increased risk of concussion. As the rules of engagement vary widely, studies of injuries in martial arts have produced varied findings. In Olympic Karate, unlike other full contact martial arts, only minimal contact is allowed to the head. This study was designed to determine the rate of concussion in top-level karate competition.

In this prospective, cohort design, data were collected during four, consecutive World Karate Federation (WKF) Championships. By rule, any suspected injury during competition was seen by a tournament doctor. Each encounter was recorded. Potential concussions were evaluated by a neurologist and a neurosurgeon. Concussions were defined as, when after an impact to the head, an athlete suffered a loss of consciousness, loss of balance, amnesia, dizziness or disorientation. If a concussion was suspected and not confirmed, it was recorded as a suspected concussion.

Data were recorded for 4,625 bouts, from which were identified four concussions and 15 suspected concussions. The risk of concussion was 0.43 per 1,000 athletic exposures, while the risk of suspected concussion was 1.62 per 1,000 athletic exposures. For males, the risks of suspected concussion and concussion were 1.71 and 0.51, per 1,000 athletic exposures respectively for males, and for females were 1.46 and 0.29 per 1,000 athletic exposures respectively.

Conclusion: This prospective study of data from consecutive World Karate Federation Championships demonstrates that the risk of concussion in these tournaments is low.

Arriaza, R., et al. Low Risk of Concussions in Top-Level Karate

Competition. *Br J Sports Med.* 2017, February; 51(4): 226-230.

LOCAL BLOCK FOR PERSISTENT BREAST SURGERY PAIN

After breast cancer surgery, 15%-25% of patients develop persistent pain (PPBCS). Up to 77% of these patients experience pain in the area supplied by the pectoral nerves, with contributions from the cutaneous branches of the intercostal nerves T2-T6. This study examined the effects of a Pecs local anesthetic (LA) block on pain and sensory function in patients with PPBCS.

Subjects were adult women, post-breast cancer surgery, with daily breast pain lasting at least six months post-surgery. The subjects were assessed for pain function and sensory function prior to and 30 minutes after, as well as in the first seven days after, the administration of an ultrasound-guided Pecs LA block. The Pecs blockade was performed under ultrasound, injecting 20 ml of 0.25% bupivacaine under the pectoralis minor between the two pectoralis muscles, using a single injection site. Pain was assessed with a numeric rating scale (NRS) in the supine position, with arm movement, and with pressure applied. In addition, quantitative sensory testing was completed.

The women's mean age was 58.5 years, with mean body mass index of 27.7 kg/m². While pain at rest was not significantly reduced after the block ($p=0.11$), pain on movement and pain with pressure were significantly reduced ($p=0.05$ and $p=0.02$, respectively). Pain scores and sleep quality were significantly improved on each of the first seven days post-injection ($p=0.02$ and $p=0.01$, respectively).

Conclusion: This pilot study of women with chronic pain after breast cancer surgery found that a local

anesthetic block could reduce pain for up to one week.

Wijaysinghe, N., et al. Analgesic and Sensory Effects of the Pecs Local Anesthetic Block in Patients with Persistent Pain after Breast Cancer Surgery: A Pilot Study. *Pain Practice.* 2017, Feb; 17(2): 185-191.

INTERMITTENT LOWER LIMB OCCLUSION FOR MUSCLE RECOVERY

Strenuous eccentric muscle contractions can lead to exercise-induced muscle damage (EIMD.) This effect can decrease muscle performance and lead to pain in the days following exercise. Therapies to reduce EIMD include antioxidants, nonsteroidal anti-inflammatory drugs, cryotherapy and compression garments. Recently, the use of intermittent vascular occlusion (OCC) has been found to be effective for improving the recovery process. This study was designed to further evaluate the effect of OCC on the recovery processes following EIMD.

Subjects were 16 healthy recreationally active male participants, with a mean age of 22 years. After an initial familiarization session, the participants reported to the laboratory for four consecutive days. Muscle damage was induced by repeated drop jumps from a 0.6 m height, with five sets of 20 repetitions, separated by two minutes of recovery. Following this EIMD protocol, bilateral arterial occlusion cuffs were placed on the proximal thigh and inflated to either 220 mmHg (OCC) or 20 mmHg (control) for five minutes followed by five minutes of reperfusion. This process was repeated three times, totaling 30 minutes. Muscle performance was measured for maximum voluntary contraction (MVC) and vertical jump height (JH) at baseline and again at 24, 48 and 72 hours. In addition, the

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extension peak torque of the dominant leg was measured, with labs taken to determine plasma creatinine kinase (CK).

Compared with the control group, the treatment group had significantly better MVC when measured at 24, 48 and 72 hours after exercise ($p < 0.05$ for all comparisons). The CK levels were lower in the treatment group at 24 and 48 hours than in the control group ($p < 0.05$ for both comparisons). Muscle soreness was also significantly lower in the treatment group than in the control group at 24, 48 and 72 hours ($p < 0.05$ for all comparison).

Conclusion: This study demonstrated that intermittent lower limb occlusion immediately after exercise-induced muscle damage can reduce muscle soreness and decrements in the maximum isometric voluntary contraction at 24, 48 and 72 hours.

Page, W., et al. The Effect of Intermittent Lower Limb Occlusion on Recovery Following Exercise-Induced Muscle Damage: A Randomized, Controlled Trial. *J Sci Med Sport*. 2017.doi.org/10.1016/j.jsams.2016.11.015

BRIEF INTENSE STAIR CLIMBING AND CARDIORESPIRATORY FITNESS

While public health guidelines prescribe 150 minutes of weekly, moderate intensity activity, some advocate for 75 minutes of vigorous activity as an alternative based on similar energy expenditures between the two. This study explored the benefit of brief, intense stair climbing exercise to improve cardiorespiratory fitness.

Two separate studies were conducted with a total of 31 sedentary women. The subjects were involved in either three, 20 second, or two 60 second all-out efforts of stair climbing, three days per week for six weeks. Heart rate was monitored continuously, and finger prick blood lactate concentrations and RPE were measured before the first and immediately after the last bout. The participants were tested for VO_2 peak, modified Canadian Aerobic Fitness Test (mCAFT) results, resting blood pressure and glucose tolerance.

The subjects climbed an average of 58 stairs during each 20-second bout. The participants improved by 11% in stairs climbed per session from week one to week six. The mean heart rate for the entire 10-minute session was 80% of the maximum heart rate. The VO_2 peak, measured directly, increased by 12% after training ($p < 0.001$) with the 20 second protocol and 8% with the 60 second protocol ($p = 0.001$). Significant increases were noted in the 60 second protocol in body mass index ($p = 0.02$), body mass ($p < 0.001$) and fat-free mass ($p < 0.001$), but no significant changes in fat mass, blood pressure, fasting insulin concentration or glucose tolerance.

Conclusion: This study demonstrated that a brief (30-minute) intense stair climbing protocol, three times per week, may be a time efficient strategy to improve cardiorespiratory fitness.

Allison, M., et al. Brief Intense Stair Climbing Improves Cardiorespiratory Fitness. *Med Sci Sports Exerc*. 2017. DOI: 10.1249/MSS.0000000000001188.

NITRATE SUPPLEMENT AND PERFORMANCE

Recent studies have demonstrated that dietary nitrate supplementation can improve performance in short duration, moderate intensity, aerobic exercise. This study investigated the influence of dietary nitrate supplementation on exercise performance.

Participants were 27 untrained, healthy males. At baseline, all were assessed by standard anthropometric measurements, $VO_{2\text{ max}}$, ventilatory thresholds (VT) and maximum work rate. The subjects were then matched for $VO_{2\text{ max}}$, and randomly assigned to either a sprint interval training plus nitrate group (SIT-nitrate) or a SIT-placebo group. The SIT-nitrate group consumed two nitrate-rich peach gels, containing eight mmol nitrate at 2.5 hours prior to each SIT session. Nine instructor led sessions of SIT occurred over a period of three weeks. Blood was drawn before and after each session to measure plasma nitrate, blood glucose and blood lactate concentrations.

Following a two-minute warm-up at 50 W, a load corresponding to 0.07 kgkg^{-1} of body mass was applied to

the bike and participants were verbally encouraged to maintain the highest cadence possible for 15 seconds. Peak power and mean power during the sprint were calculated. Participants then completed four minutes of active recovery at 50W before repeating the process three more times.

At follow-up, $\text{VO}_2 \text{ max}$ and ventilatory threshold (VT) increased in both groups, with no significant difference between groups. The maximum work rate increased 8.7% in the nitrate group and 4.7% in the placebo group ($p=0.07$), with fatigue reduced more in the nitrate group than in the placebo group ($p=0.058$), though neither reached statistical significance.

Conclusion: In this study of previously untrained males, dietary nitrate supplementation did not significantly improve $\text{VO}_2 \text{ max}$ and VT.

Muggerridge, D., et al. The Effects of Dietary Nitrate Supplementation on the Adaptations to Sprint Interval Training in Previously Untrained Males. *J Sci Med Sport*. 2017, Jan; 20(1): 92-97.

BETA ALANINE USE AMONG PROFESSIONAL FOOTBALLERS

A number of studies have demonstrated that supplementation with beta alanine can improve high-intensity and intermittent exercise. However, little is known about the use of this supplement among professional athletes. This study was designed to estimate the prevalence of beta alanine supplementation among professional rugby and Australian Rules Football (ARF) players.

An anonymous questionnaire, consisting of 38 questions, was administered to professional athletes from teams in the Australian Football League (ARL), in the National Rugby League (RL) and Super Rugby (RU) football competitions. Questionnaires were designed to gather information regarding demographics, knowledge, use, side effects and sources of information regarding beta alanine.

Of the 785 surveys sent, 570 were returned. Of those who responded, 61% reported that they used beta alanine. Nonusers reported a lack of knowledge as the primary reason for nonuse. Of the users, 15% supplemented with the recommended

dose of 46 g per day, while 50% were consuming less than half of the recommended dose. Of those supplementing, 37% were supplementing one to three times per week, 21% four to six times per week and 12% more than six times per week. The main sources of information influencing the decision to use this supplement were the strength and conditioning coach, followed by the dietitian.

Conclusion: This study of Australian professional football players found that the majority of athletes supplement with beta alanine, although the majority use the supplement in a manner inconsistent with recommendations.

Kelley, V., et al. Prevalence, Knowledge and Attitudes Relating to Beta Alanine Use among Professional Footballers. *J Sci Med Sport*. 2017, January; 20(1): 12-16.

CANNABIS AND EARLY STROKE

A growing body of research has linked cannabis use to stroke, particularly among those occurring before the age of 45 years. This study was designed to clarify the association between cannabis use and early onset of stroke.

Data were derived from a national survey of Swedish men, between 18 and 20 years of age, conscripted into the military service from 1969 to 1970. During a two-day screening, questionnaires which included drug use data were administered. Based on the responses, the frequency of cannabis use, tobacco use, and alcohol use were divided into four categories. The group was followed for the initial occurrence of strokes between 1971 until 2009.

Among the 49,321 men included in the analysis, 1,037 first-time strokes occurred during the follow-up period. Before the age of 45 years, 192 first-time strokes had occurred of which 40% were ischemic and 27% hemorrhagic. No significant association was found between cannabis use in young adulthood and stroke before the age of 45 years. Stroke before the age of 45 was more than six times more prevalent among men reporting smoking more than 20 cigarettes per day than among nonsmoking men, and four times higher among men reporting high alcohol consumption than among

those with no alcohol consumption. However, a multivariable analysis determined that only cigarette smoking was robustly associated with stroke before the age of 45.

Conclusion: This study found no clear association between cannabis use in young adulthood and the risk of early stroke.

Falkstedt, D., et al. Cannabis, Tobacco, Alcohol Use, and the Risk of Early Stroke. A Population Based Cohort Study of 45,000 Swedish Men. *Stroke*. 2017, Feb; 48(2): 265-270.

BEZLOTOXUMAB FOR RECURRENT CLOSTRIDIUM DIFFICILE

Within high income countries, *Clostridium difficile* (C. Diff) is the most common cause of infectious diarrhea among hospitalized patients. However, after completing antibiotic therapy, up to 35% of patients have recurrent C. Diff infections. As Bezlotoxumab is a monoclonal antibody that binds and neutralizes C. Diff toxin B, this study examined the safety and efficacy of this medication alone or combined with actoxumab (antibody binding to toxin A).

The participants were adults with primary or recurrent C. Diff who participated in one of two trials, (MODIFY I or MODIFY II). All subjects received oral standard of care antibiotics for 10 to 14 days. The patients were randomly assigned to receive a single IV dose of bezlotoxumab at 10 mg/kg, actoxumab at 10 mg/kg, plus bezlotoxumab, placebo, or actoxumab alone. The primary endpoint was the proportion of participants with recurrent C. Diff infection during 12 weeks of follow-up.

Pooling the data from the two studies, the rate of initial clinical cure was 80% in the bezlotoxumab group 80% in the placebo group and 73% in the combined set. In both trials the percentage of participants who had a recurrent infection was significantly lower in the bezlotoxumab group than in the placebo group ($p<0.001$). In the MODIFY 1 trial the combination group had a lower recurrence rate than did the placebo group ($p<0.001$). The actoxumab group did not have a

significantly lower recurrence rate than did the placebo group.

Conclusion: This study of patients with C. Diff infections found that a one-time treatment with bezlotoxumab, a monoclonal antibody binding to C. Diff toxin B, significantly reduced the risk of recurrence.

Wilcox, M., et al. Bezlotoxumab for Prevention of Recurrent Clostridium Difficile Infection. **New Eng J Med.** 2017, January 26; 376(4): 305-317.

OUTCOME MARKER FOR IVIG TREATED GUILLAIN-BARRÉ SYNDROME

Intravenous immunoglobulin (IVIG) has been the treatment of choice for Guillain-Barré syndrome (GBS), with varying recovery and outcome. As serum albumin has been identified as an independent factor associated with outcome in amyotrophic lateral sclerosis and Kawasaki disease, this study aimed to determine whether serum albumin levels can serve as a prognostic marker in patients with severe GBS treated with IVIG.

A cohort of patients with GBS participated in two previously conducted clinical trials between May 5, 1986, and August 2, 2000. Serum samples were obtained from 174 patients before and after IVIG treatment at four standardized time points. The main outcome measures were muscle weakness, respiratory failure and ability to walk. Serum albumin levels were measured before and after treatment.

Before treatment, the median serum albumin level was 4.2g/dl, with hypoalbuminemia in 20 (albumin<3.5g/dl) participants. Two weeks following treatment with IVIG, the median serum albumin level fell to 3.7g/dl. The number of participants with hypoalbuminemia increased to 60 (p<0.001). Hypoalbuminemia was associated with respiratory failure (p<0.001), muscle weakness at four weeks (p<0.001) and six months (p<0.001) and inability to walk (p<0.001). A logistic regression analysis identified serum albumin as an independent factor associated with outcome.

Conclusion: This study found serum albumin to be an independent factor associated with the prognosis of patients with Guillain-Barré syndrome treated with IVIG.

Fokkink W., et al., Association of Albumin Levels with Outcome in Intravenous Immunoglobulin-Treated Guillain-Barré Syndrome. **JAMA Neurol.** 2017, February; 74(2): 189-196.

RISK OF STROKE WITH HERPES ZOSTER

Herpes zoster (HZ) is a common, painful disease affecting millions of people every year in developed countries. While some researchers have suggested that HZ plays an important role in the development of stroke, the association remains controversial. This meta-analysis was designed to better clarify the relationship between HZ and stroke risk.

A literature search was conducted, with six cohort studies identified, involving 251,076 patients with HZ and 8,462 cases of stroke. The relative risks from the studies were pooled, with several subgroup analyses conducted.

The combined relative risk (RR) for stroke among patients with HZ compared to those without was 1.36, representing a 36% higher risk of developing stroke. For those with HZ ophthalmicus, three studies were included, with a pooled relative risk of 2.62 (p=0.092). The risk of stroke for patients with HZ was greatest in the first three months (RR 1.94).

Conclusion: This literature review and meta-analysis reaffirms the relationship between herpes zoster and the risk of stroke, with this risk greatest within first three months of infection.

Yang, S., et al. Risk of Stroke in Patients with Herpes Zoster: A Systematic Review and Meta-analysis. **J Stroke Cerebrovasc Dis.** 2017, February; 26(2): 301-307.

RECURRENCE OF POSTERIOR CIRCULATION CHILDHOOD ARTERIAL ISCHEMIC STROKE

Childhood arterial ischemic stroke (CAIS) is thought to affect 1.6 per 100,000 children per year. While clinical observations have suggested that CAIS in the posterior circulation (PCAIS) recurs at higher rates than do those involving the anterior

circulation (ACAIS), this phenomenon has not previously been well demonstrated. This study was designed to better understand the risk of recurrence in children with PCAIS compared to ACAIS.

This retrospective analysis included a consecutive cohort of children with CAIS presenting to the Children's Hospital of Philadelphia between January of 2006 and January of 2015. The charts were reviewed for patients with isolated PCAIS, defined as parenchymal infarction located only within the region supplied by the vertebrobasilar system. A recurrent ischemic event was defined as a new clinical event with symptoms conforming to an arterial distribution and confirmed radiographically, or a clinically asymptomatic new infarction identified on follow-up surveillance imaging.

From the chart scan, 107 children with isolated CAIS were identified, with 57% having isolated ACAIS and 43% having isolated PCAIS. Of these, 11 patients (10.3%) experienced a recurrence, with 10 of these occurring within the first six months after CAIS. Ten of the 11 recurrences remained within the same arterial distribution as the incident infarction. Univariable and multivariable analyses revealed that only PCAIS was associated with an elevated risk of recurrence. The adjusted hazard ratio for recurrence after PCAIS as compared with ACAIS was 5.3 (p=0.04).

Conclusion: This study of children with arterial ischemic stroke found that recurrence occurs in 10.3% of these patients within three years, with recurrence more common after infarctions isolated to the posterior circulation than in those isolated to the anterior circulation.

Uohara, M., et al. Incidence of Recurrence in Posterior Circulation Childhood Arterial Ischemic Stroke. **JAMA Neurol.** 2017. doi:10.1001/jamaneurol.2016.5166.

AMITRIPTYLINE, TOPIRAMATE FOR PEDIATRIC MIGRAINE

More than six million children and adolescents in the United States suffer from migraines. This study, the Childhood and Adolescent Migraine Prevention (CHAMP) trial, compared the effects of treatment with

amitriptyline and topiramate, the two most commonly used migraine prevention medications, on the clinical course of migraine headaches.

Participants were children and adolescents, eight to 17 years of age, all diagnosed with migraine, and with a headache frequency of four or more days per month. After baseline evaluation, the subjects were randomized to receive oral amitriptyline at one mg/kg, topiramate at two mg/kg or placebo in a divided dose, one capsule twice per day. All subjects completed a daily headache diary, with the PedMIDAS used to assess the effect of migraines on school, home, play and social activities. The primary outcome variable was a relative reduction of 50% or more in the number of headache days, as compared with a 28-day baseline evaluation.

In the intention to treat analysis of 328 patients, the percentage of patients who had a relative reduction of 50% or more in the number of headache days was 52% in the amitriptyline group, 55% in the topiramate group and 61% in the placebo group. There was no difference in the effect of the two active drugs when compared with one another.

Conclusion: This study of children and adolescents with migraines failed to demonstrate that either amitriptyline or topiramate reduces the frequency of headache related disability as compared to placebo.

Powers, S., et al. Trial of Amitriptyline, Topiramate, and Placebo for Pediatric Migraine. *N Eng J Med.* 2017, January 12; 376(2): 115-124.

ANTICOAGULATION AFTER INTRACEREBRAL HEMORRHAGE IN PATIENTS WITH ATRIAL FIBRILLATION

Studies of patients with atrial fibrillation (a-fib) who have sustained an intracerebral hemorrhage have produced conflicting recommendations for the timing of the resumption of oral anticoagulation. This study was designed to better clarify this issue.

Using the Swedish Stroke Registry, data were obtained from patient records between July of 2005

and December of 2012. Records were reviewed for subjects diagnosed with a-fib, with hospital admission for first-ever intracerebral hemorrhage (ICH). Records were also reviewed for comorbidities and treatments, including anticoagulation and antiplatelet therapy. The patients' profiles were then characterized by risk of ICH.

Data were available from 2,662 patients who survived a hospital discharge after first-ever ICH, and who also had a-fib. At follow-up, 379 severe thrombotic events occurred, of which 79.7% were ischemic strokes. Of the 115 severe hemorrhagic events, 83.5% were recurrent intracerebral hemorrhage events. At three years, the cumulative incidence of thrombotic events was 14.5%, and the incidence of severe hemorrhagic events was 4.4%. In the high risk population, anticoagulant treatment was associated with a reduced risk of vascular death and nonfatal stroke, with no significant increase in the risk of severe hemorrhage. The benefits seemed to be greatest when treatment began at seven to eight weeks after the initial hemorrhagic event.

Conclusion: This study of patients with first-ever intracerebral hemorrhage with a concurrent diagnosis of a-fib found that anticoagulation treatment may be best when initiated at seven to eight weeks post-hemorrhage.

Pennlert, J., et al. Optimal Timing of Anticoagulant Treatment after Intracerebral Hemorrhage in Patients with Atrial Fibrillation. *Stroke.* 2017, February; 48(2): 314-320.

HEPATITIS E AND GUILLAIN-BARRÉ SYNDROME

Approximately two thirds of patients with Guillain-Barré syndrome (GBS) have symptoms of an infection in the three weeks before the onset of weakness. While not among the most common infectious causes, an association between infection with hepatitis E virus (HEV) and GBS has been suspected in recent years. This virus is usually transmitted zoonotically in humans, by consuming undercooked meat or contaminated water. This study retrospectively assessed the prevalence of acute HEV infection in a cohort of patients with GBS.

Data were collected from the medical records of all patients with GBS presenting to a neurology department between January of 2007 and November of 2015. Data collected included clinical features of GBS, with laboratory results, including electrodiagnostic testing, alanine aminotransferase (ALT), and total bilirubin levels, as well as lumbar puncture findings of anti-ganglioside or anti-sulfatide antibodies, testing for HEV IgM and IgG, as well as serologic tests of serum and stool cultures.

Of the 73 patients in the study, a positive anti-HEV IgM was found in six, with 67% of these demonstrating ALT levels 1.5 times normal. In addition, 18% had positive IgG serologic findings for HEV. No significant correlations were seen between clinical parameters of GBS and the presence of HEV antibodies.

Conclusion: This study found that the hepatitis E virus is frequently associated with Guillain-Barre' Syndrome with abnormal alanine aminotransferase levels at admission suggestive of the presence of an associated hepatitis E infection.

Stevens, O., et al. Diagnostic Challenges and Clinical Characteristics of Hepatitis E Virus-Associated Guillain-Barré Syndrome. *JAMA Neurol.* 2017, January; 74(1): 26-33.

CARDIOVASCULAR AND HEMODYNAMIC RESPONSES TO WEIGHT TRAINING WITH BLOOD FLOW RESTRICTION

While resistance exercise increases the development and maintenance of strength, muscular endurance and hypertrophy, some individuals are unable to train with a heavy load (>70% of 1RM). As some evidence suggests that low loads may be effective when combined with blood flow restriction (BFR), this study was designed to determine the acute effects of eccentric resistance exercise combined with BFR on cardiovascular and hemodynamic responses.

Subjects were 16, recreationally active, male college students. All had a body mass index of less than 30 kg/m², a resting heart rate of less than 95 beats per minute, a resting blood pressure (BP) of less than 140/90 mmHg and no history of recent

regular resistance or aerobic exercise. Baseline data were obtained, including anthropometric measurements and maximum voluntary contraction of the knee extensor.

The participants were divided into groups to perform high intensity resistance (Hi-RE) exercise, low intensity exercises alone (Li-RE) or low intensity exercises combined with blood flow resistance (BFR-RE). The subjects then performed four sets of resistance exercise, with pre- and post-measurements of heart rate (HR), BP, blood oxygen saturation, stroke volume (SV), total peripheral resistance (TPR), and rate of perceived exertion. Those in the BFR-RE group exercised with a pneumatic cuff producing a restriction pressure of 90 to 100 mmHg.

Significantly greater systolic BP, diastolic BP, and HR were achieved in the Hi-RE and the Li-RE groups than in the BFR-RE group ($p<0.05$). The SV, CO and TPR showed significantly greater values for the Li-RE group than for the Hi-RE and BFR-RE groups ($p<0.05$).

Conclusion: This study found that eccentric exercise at 30% of the one-rep max with blood flow restriction can produce a lower hemodynamic response than similar exercises without blood flow restriction or heavy load exercises.

Bazgir, B., et al. Hemodynamic Responses to Blood Flow Restriction and Resistance Exercise to Muscular Failure. *Intern J Sports Med.* 2017; 38: 134-140.

ARTERIAL STIFFNESS AND RESISTANCE TRAINING IN YOUNG MEN

Guidelines of the American College of Sports Medicine/American Heart Association recommend moderate to high intensity resistance exercise training, at least two days per week, to achieve health benefits separate from those achieved with aerobic activity. As previous studies have suggested that heavy loads, but not moderate loads, are associated with improvements in arterial stiffness, this study compared changes in arterial stiffness with traditional heavy load, low repetition training versus lighter load, high repetition training.

Subjects were 46, healthy, active males who had performed resistance

exercise training for at least two years. The subjects were randomized to one of three groups. A high repetition (HR) group performed three sets of 20-25 repetitions per set at 30-50% of a one-rep maximum to volitional failure. A low repetition group performed three sets of eight to 12 repetitions per set at 75-90% of a one-rep maximum to volitional failure. A control group was matched for baseline fat-free mass and strength.

Muscle strength was assessed at baseline and at weeks four, seven and 10 to adjust the one-rep maximum. Vascular assessment was completed one week before and one week after the intervention period, using central arterial stiffness [carotid-femoral pulse wave velocity (cfPWV)], local arterial stiffness (common carotid arterial distensibility), and left ventricular mass.

Resting heart rate was reduced in both treatment groups ($p<0.05$), with no such change in the control group. The cfPWV was reduced to a similar degree in both treatment groups ($p<0.05$), with no change in the control group. No changes were noted in any group on measures of local common carotid artery distensibility or the beta stiffness index.

Conclusion: This study of previously trained, young males found that 12 weeks of resistance training, regardless of the per repetition load lifted, reduced central arterial stiffness, known to be an independent predictor of cardiovascular disease risk.

Au, J., et al. Arterial Stiffness is Reduced, Regardless of Resistance Training Load, in Young Men. *Med Sci Sports Exerc.* 2017; 49(2): 342-348.

PLASMA TAU AND RETURN TO PLAY AFTER CONCUSSION

Despite the 3.8 million sports-related concussions (SRCs) occurring annually in the United States, there are still no prognostic biomarkers to predict recovery. Tau has been found to be linked to axonal damage, as well as to return to play, among ice hockey players. This study was designed to better understand the relationship between increases in tau following a concussion and time to return to play (RTP).

Between 2009 and 2014, 632 National Collegiate Athletic Association Division I and division III contact sport athletes underwent plasma tau baseline sampling and cognitive testing prior to the beginning of the sports season. Those with an SRC underwent plasma sampling within six hours of injury, and then at two, three and seven days post-injury. Plasma sampling was also performed for noncontact athletic controls and nonathletic controls. Return to play was determined by the athletic trainers or team physicians. Clinical outcome after concussion was determined by changes in cognitive performance, post concussive symptoms and postural stability.

During the study, 48 athletes were diagnosed with SRC and were compared with 37 non-concussed athletes. Both athletic groups had significantly higher mean tau concentrations than did non-athletes at baseline, as well as at all other time points. Compared with the control athletes, the concussed athletes had lower mean tau levels at 24 ($p=0.03$) and 72 hours ($p=0.04$). Compared to those allowed RTP within 10 days, those restricted from RTP for more than 10 days had higher overall concentrations of tau at six ($p<0.01$), 24 ($p<0.01$), and 72 hours ($p<0.01$). Plasma tau level at six hours post-concussion was a significant predictor of a RTP of 10 days or more ($p<0.01$).

Conclusion: This study demonstrates that plasma tau concentration within six hours after sports-related concussion is related to a prolonged return to play.

Gill, J., et al. Acute Plasma Tau Relates to Prolonged Return to Play after Concussion. *Neurol.* 2017, February 7; 88: 595-602.

HAMSTRING FLEXIBILITY VERSUS HAMSTRING INJURIES IN SOCCER

Among amateur soccer players, hamstring injuries account for 16% of all injuries. In addition, the risk of recurrence is thought to be over 15%. Some have suggested that increasing hamstring flexibility may reduce the risk of this injury, though this relationship remains unclear. This study investigated the relationship between hamstring flexibility and hamstring injuries in male amateur soccer players.

Between October and November of 2002, all male first-class, amateur soccer teams in the Netherlands were invited to participate in the study. All participants received information providing details of the study. Of those who agreed to participate, patient characteristics were collected using a questionnaire that queried age, years of soccer experience, field position and hamstring injuries in the year before the study. To measure hamstring flexibility, the Sit and Reach Test (SRT) was conducted by the medical staff for the soccer team. The players were then followed for hamstring injuries.

The final analysis was completed using data from 450 participants, with a mean age of 24.5 years. During the year of the study, 23 injuries were reported, resulting in a hamstring injury rate of 5.1%. The multivariate analysis revealed no significant relationship between hamstring flexibility and hamstring injury. Age and previous hamstring injuries were also not significantly related to hamstring injuries in either the univariate or the multivariate analyses ($p=0.176$ and $p=0.285$, respectively).

Conclusion: This study of high-level, male, amateur soccer players found no significant relationship between hamstring flexibility and the risk of hamstring injury.

Doormaal, M., et al. No Relationship between Hamstring Flexibility and Hamstring Injuries in Male, Amateur Soccer Players. *Am J Sports Med.* 2017, January; 45(1): 121-126.

U.S. HIGH SCHOOL SOCCER INJURIES

Soccer is one of the fastest growing sports in the United States, with male participation growing by four-fold and female participation by 35-fold between 1973 and 2014. This study reviewed the change in the number of soccer injuries in high school athletes between 2005/2006 and 2013/2014.

This prospective, epidemiologic study used data collected from the National High School Sports-Related Injury Surveillance System, High School Reporting Information Online (RIO). Data were gathered by board certified athletic trainers who reported exposure and injury data for athletes participating in sanctioned high school soccer programs. Athletic trainers completed detailed reports

for each injured athlete, with injuries defined as occurring as a result of participation, requiring medical attention and resulting in the restriction of the athlete's participation for at least one day beyond the date of the injury.

Overall, the injury rate was 2.06 per 1,000 athletic exposures. The most common diagnoses were ligament sprains in 29.7%, concussions in 17.9% and muscle strains in 16.1% of the injuries. Compared with practice, injury rates were significantly higher in competition (RR 3.55). Injury rates were significantly higher in girls (RR 1.27) than in boys. Between 2005/2006 and 2013/2014, non-concussion injuries decreased in boys, but not in girls. During that same time interval, concussion rates increased in both girls and boys.

Conclusion: This study of injuries in high school soccer players found that, over the past nine years, overall injuries decreased in boys and increased in girls, while concussion diagnoses increased in both genders.

Khodaei, M., et al. Nine-Year Study of U.S. High School Soccer Injuries: Data from International Sports Injury Surveillance Program. *Br J Sports Med.* 2017, February; 51(3): 185-193.

PELVIC AND HIP FRACTURE RISK ASSOCIATION WITH ANTIHYPERTENSIVE MEDICATIONS

People with hypertension have more osteoporotic fractures than do people without hypertension. The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) was a large, randomized, clinical trial comparing the effects of different classes of antihypertensive drug therapy in preventing heart disease. This study used data from the ALLHAT database to compare specific antihypertensive use with the risk of hip fracture.

This randomized, double-blind, active controlled, clinical trial included hypertensive women 55 years of age or older. The study compared first-step treatment with the thiazide-type diuretic, chlorthalidone ($n=15,255$), the calcium channel blocker, amlodipine, ($n = 9048$), the α -receptor blocker, doxazosin, ($n = 9061$) and the angiotensin-converting inhibitor, lisinopril ($n = 9054$). The doxazosin

arm was dropped early, due to the higher risk of CVD compared with chlorthalidone. Hip and pelvic fractures were determined by hospital data between 1994 and 2006. The incidence of fractures was calculated, beginning one year after study enrollment.

During a mean follow up of 4.9 years, 34 participants had pelvic fractures and 307 had hip fractures. A fully adjusted hip and pelvic fracture hazard ratio revealed that chlorthalidone was associated with a significantly lower risk of fracture than amlodipine or lisinopril. This finding was true for all subgroup comparisons.

Conclusion: This study found that the thiazide-type diuretic, chlorthalidone, is associated with a lower risk of pelvic fracture than are amlodipine and lisinopril.

Puttman, R., et al. Association of Three, Different Antihypertensive Medications with Hip and Pelvic Fracture Risk in Older Adults: Secondary Analysis of a Randomized, Clinical Trial. *JAMA Internal Med.* 2017, January; 177(1): 67-76.

NEWER ANTIDEPRESSANTS WITH PREGABALIN FOR FIBROMYALGIA SYNDROME

Studies have shown that pregabalin, in combination with serotonin-norepinephrine reuptake inhibitors (SNRI) can be beneficial for the treatment of pain, fatigue and sleep disorders in fibromyalgia (FM). This study compared the use of pregabalin with amitriptyline, venlafaxine or paroxetine for symptoms of fibromyalgia.

The subjects were 75 adult women, previously diagnosed with FM, all of whom had experienced a poor response to pain medications, physical therapy and psychological support. Each patient received a single, daily dose of pregabalin at 75 mg. In addition, the patients were randomized to receive one additional medication, including oral amitriptyline at 25 mg per day, venlafaxine at 75 mg per day or paroxetine at 25 mg per day. The subjects were assessed bimonthly for six consecutive months. The primary outcome variable was the change in somatic symptoms, as measured by the SSS-8. Secondary outcome measures included the CESDS

(Continued from page 2)

*Bonnie Weigert, M.D.
Michael Suer, M.D.
Tyler Klein
University of Wisconsin, Madison, WI

*Chris Arbonies, M.D.
Christopher Beal, D.O.
Daniel Contract, M.D.
Adam Hills, M.D.
Thomas Phan, M.D.
VCU, Richmond, VA

*Rucha Kharod, M.D.
Charles Gonzales, M.D.
Washington University, St. Louis, MO

Executive Editor Emeritus

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Subscription Manager

Michael P. Burke, M.S.

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(depression) score, life satisfaction, mood, sleep quality, fatigue, medication tolerability and adverse events.

The combination which included paroxetine resulted in significantly lower SSS-8 scores from 10 weeks ($p<0.001$) as well as 18 weeks ($p<0.001$) after the initiation of the study medications as compared with pregabalin plus amitriptyline or venlafaxine. This combination also resulted in lower CESDS scores from 10 weeks after the initiation of study medications until the end of the study ($p<0.001$). This combination further resulted in higher medication tolerability ($p<0.001$), and a greater number of patients with elevated mood, and good life satisfaction and sleep quality ($p<0.05$).

Conclusion: This study of patients with fibromyalgia found that combining pregabalin with paroxetine improves pain, affect and function more than combining pregabalin with amitriptyline or venlafaxine.

Ramzy, E., et al. Comparative Efficacy of Newer Antidepressants in Combination with Pregabalin for Fibromyalgia Syndrome: A Controlled, Randomized Study. **Pain Practice.** 2017, January; 17(1): 32-40.

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