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HIGH-DOSE VITAMIN D VERSUS BONE DENSITY AND STRENGTH

Recent meta-analyses have not supported a major treatment benefit of vitamin D for osteoporosis or for preventing falls or fractures. As three percent of the United States population consumes daily doses of at least 4,000 international units (IU) of vitamin D, this study assessed the effect of high-dose vitamin D on bone density and strength.

This double-blind, randomized, clinical trial included healthy men and women, 55 to 70 years of age. The subjects were allocated to one of three groups, including vitamin D supplementation with 400IU, 4,000IU or 10,000 IU daily. Excluded were those who had used bone active medication within the past two years or had previous clinical assessments compatible with osteoporosis. Primary outcome variables were high-resolution peripheral quantitative computed tomography (HRpQCT) measurements at baseline, six, 12, 24, and 36 months, as well as total volumetric bone mineral density (BMD) at the distal radius and tibia and bone strength (failure load) by finite element analysis at the distal radius and tibia, for a total of four primary variables.

A final analysis was completed for 287 subjects. At both the tibia and the radius, total volumetric BMD displayed a negative dose-response relationship, with greater loss associated with higher dose supplementation. There were no differences between groups in changes in failure load.

Conclusion: This randomized, controlled trial found that vitamin D supplementation of 4,000 or 10,000 international units in healthy adults was associated with a greater loss in bone mineral density as compared to supplementation with 400 international units.

Burt, L., et al. Effect of High-Dose Vitamin D Supplementation on Volumetric Bone Density and Bone Strength. A Randomized, Clinical Trial. *JAMA*. 2019, August 27; 322 (8): 736-745.

CURCUMIN INHIBITS JOINT CONTRACTURE

Joint contracture is a clinical problem that affects joint function. Prior studies have shown that phosphatase and tension homolog (PTEN) play a role in fibrosis. Others have found that curcumin has antifibrotic effects in the liver and lung, and that changes in DNA methylation may play an important role in curcumin's multiple pharmacological properties. This study investigated the effects of curcumin on joint contracture.

Joint capsules were collected from patients with joint contracture and from a control group without joint contracture. Capsules were used for the isolation and culture of fibroblasts, with fibroblasts then induced using a transforming growth factor. These samples were then exposed to curcumin for 72 hours. The cells were assessed for cell viability, migration, collagen production and RNA.

Western blot analysis revealed that PTEN expression was lower in the contracture capsule tissues than in normal capsule tissues ($p < 0.05$) and decreased in the curcumin group ($p < 0.05$). Those treated with curcumin demonstrated a restoration of PTEN expression, downregulated α -SMA expression and suppressed proliferation and migration of myofibroblasts by demethylation and inhibition of PI3K/Akt/mTOR signaling.

Conclusion: This study of joint capsule tissue found that curcumin can upregulate tumor suppression gene PTEN expression and inhibit the proliferation and migration of myofibroblasts.

Zhuang, Z., et al. Curcumin Inhibits Joint Contracture through PTEN Demethylation and Targeting PI3K/Akt/mTOR Pathway in Myofibroblasts from Human Joint Capsule. **Evidence-Based Complementary and Alternative Medicine.** <https://doi.org/10.1155/2019/4301238>.

ANKLE INJURIES IN COLLEGIATE SOCCER

Previous studies have found that, among National Collegiate Athletic Association (NCAA) soccer players, ankle injuries occur at a rate of 7.5 per 1,000 athletic exposures (AE). This study reviewed 10 years of NCAA data to determine the change in the injury rate and injury characteristics over time.

Data were obtained from the NCAA injury surveillance program. In this system, an athletic injury (AE) is defined as a traumatic event resulting in the absence from at least one practice session or competitive event. Data were reviewed for gender, diagnostic characteristics of the ankle sprain and the year of occurrence.

For the 2004-2005 through the 2013-2014 seasons, ankle injuries occurred at a rate of 1.42 per 1,000 athletic events, with no significant difference in rates noted between time periods. However, the average number of days missed during the period of 2003-2009 was 11.06, as

compared with 5.09 in the 2009-2014 seasons ($p < 0.001$). The most common ankle injury was a lateral ligament complex tear, accounting for 65.67% of the injuries. Other injuries were of the tibiofibular ligament in 10.3%, ankle contusions in 10.1% and medial deltoid ligament in 9.77%. Compared to the other ankle injuries, high ankle sprains resulted in a greater portion of athletes missing 30 or more days of participation. Injuries were three times more likely during games than in practice, and when sustained during competition, occurred more often during the second half.

Conclusion: This review of collegiate soccer ankle injuries found that the rate of ankle injuries did not change between the 2004 and 2014 seasons, although the prognosis improved over time.

Gulbrandsen, M., et al. Ten-Year Epidemiology of Ankle Injuries in Men's and Women's Collegiate Soccer Players. *J Athl Train*. 2019; 54 (8).

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APPROPRIATE RESISTANCE INTENSITY FOR INFRASPINATUS ACTIVATION

Among the rotator cuff muscles, the infraspinatus is particularly instrumental in the production of primary external rotation torque and dynamic shoulder stability. This study investigated the appropriate resistance intensity for the optimal selective activation of the infraspinatus.

Subjects were 15 healthy males who performed two exercises at three resistance levels, completed in both prone and sitting positions. Resistance was placed at low intensity (10-20%), medium intensity (45-55%) or high-intensity (60-70%). During exercise, surface EMG was used to measure the activity of the infraspinatus and posterior deltoid muscles. The infraspinatus/posterior deltoid activation ratio (AR) was measured, in order to determine the condition that best isolated the infraspinatus.

Significant differences in the AR among resistance intensity conditions were observed during both prone ($p=0.031$) and sitting ($p=0.002$) conditions. The AR was optimized at low intensity during the prone condition (3.75).

Conclusion: This study suggests that low intensity is the appropriate resistance intensity for the selective activation of the infraspinatus.

Yu, I., et al. Appropriate Resistance Intensity and Effective Exercise for Activation of Infraspinatus. *Int J Sports Med.* 2019; 40(09): 569-575.

PROFESSIONAL SOCCER RETURN TO PLAY AFTER ACHILLES RUPTURE

Previous studies have suggested that 80 percent of the general population can return to sports after an acute Achilles rupture (AAR). This study focused on male, professional soccer players, to better understand the timing and extent of recovery after an AAR.

Using internet-based injury reports, data were obtained for professional, male soccer players from 2008 to 2018 who had sustained an AAR and who underwent a surgical repair. Data were obtained on anthropometrics, playing position, team and league of play. In addition, injury history and time of return to play were retrieved, including data regarding the number of games played before and after the injury.

During the 10 years of the study, 118 AARs were identified. Return to unrestricted practice was realized in 96% of those injured after a mean of 199 days after the injury. One of the

players re-ruptured his Achilles during training, with the remaining returning to competition at an average of 274 days post-injury. The number of matches played the first season after return to play was lower, while the number of matches played the second season was similar to the number of matches played before the injury. Of the 71 athletes who played at least two full seasons, eight percent sustained a re-rupture. Of the athletes who returned to play two seasons after AAR, 82% were able to perform at a level comparable to their pre-injury status. Risk factors for not returning to the same level included age over 30 years (Odds Ratio 4.46) and re-rupture within the first two seasons (Odds Ratio 6.37).

Conclusion: This study of male, professional soccer players with an acute Achilles rupture found that the majority returned to play at an average of 274 days post-injury.

Grassi, A., et al. Eighty-Two Percent of Male, Professional Football (Soccer) Players Return to Play at the Previous Level Two Seasons after Achilles Tendon Rupture Treated with Surgical Repair. *Br J Sports Med.* 2019. doi:10.1136/bjsports-2019-100556.

WITHHOLDING JOINT REPLACEMENT IN THE MORBIDLY OBESE

Lower extremity joint replacement is associated with a relatively low complication rate. However, morbid obesity has been associated with an increased risk of complications following surgery, including infection, early failure and worse functional outcome. As a result, these surgeries are often withheld until weight can be optimized. This study reviewed the outcomes of morbidly obese patients who requested these surgeries.

Subjects were 289 patients seen between 2014 and 2015 at one orthopedics center. All had a body mass index (BMI) of over 40 kg/m², with weight serving to disqualify them from joint replacement. These patients were informed of the risk associated with arthroplasty among the morbidly obese and were given details regarding two bariatric practices in the community. The participants were prospectively followed to review their outcomes.

At a median of 2.2 years, 72% of the cohort had not undergone arthroplasty. Only 23% attended a bariatric appointment, and, of these, only 21% underwent bariatric surgery. Of those who eventually underwent joint replacement surgery, only 39.7% had successfully achieved a body mass of less than 40 kg/m² at the

time of surgery.

Conclusion: This study of patients with end-stage osteoarthritis who were initially rejected for joint replacement due to a high body mass index found that only 20% ultimately underwent joint replacement, with the majority of these remaining morbidly obese at the time of surgery.

Springer, B., et al. What Are the Implications of Withholding Total Joint Arthroplasty in the Morbidly Obese? **Bone Joint J.** 2019; 101-B (7 suppl C): 28-32.

MANAGING ACUTE ACHILLES RUPTURE

The rate of Achilles tendon ruptures has increased in the past 10 years. During that time the management of these injuries has also evolved. This study evaluated the efficacy of different treatment options.

This literature review included randomized controlled trials of patients with an acute Achilles tendon rupture that compared interventions or rehabilitation regimens. The treatments reviewed included: A) nonoperative treatment with accelerated rehabilitation; B) minimally invasive surgery with accelerated rehabilitation; C) open surgery with accelerated rehabilitation; D) nonoperative treatment with early immobilization; E) minimally invasive surgery with early immobilization; F) open surgery with early immobilization.

Of the studies reviewed, 21 were chosen with a total of 2,060 patients included in the analysis. The mean incidence of major complications was 9.13%. The risks of major complications were significantly lower among those in groups B, C, E, and F as compared to group D (relative risk of 0.22, 0.18, 0.23, and 0.42, respectively). Using the surface under the cumulative ranking curve (SUCRA) method to determine the overall effectiveness of each treatment, the best treatment was found to be group B with the worst group D.

Conclusion: This literature review and meta-analysis suggests that among the treatments for an acute rupture of the Achilles tendon, those treated with minimally invasive surgery followed by accelerated rehabilitation had the best outcome with the least complications.

Wu, Y et al. Complications in the Management of Acute Achilles Tendon Rupture: A Systematic Review and Network Meta-analysis of 2060 Patients. **Am J Sports Med** 2019, September; 47 (9): 2251–2260.

INSOMNIA AND SYMPTOM SEVERITY IN FIBROMYALGIA

Fibromyalgia (FM) is a complicated chronic pain syndrome affecting up to five percent of the general population. This study assessed the relationship between insomnia and symptom severity in patients with FM.

Data were retrieved from the Longitudinal Health Insurance Database 2010 (LHID2010) which includes medical claims data and registration files of one million Taiwanese. From these data were identified patients with incident FM. The data were also reviewed for a primary or secondary diagnosis of insomnia, as well as FM-related medications. The data were reviewed for an association between insomnia and healthcare visits.

Data were obtained for 5,466 patients with FM and insomnia (FM-I), and 12,454 patients with FM without insomnia. Compared to the FM group, those in the FM-I group had a greater incidence of depression and anxiety, as well as prescriptions for antidepressants, gabapentin, muscle relaxants and opioids ($p < 0.001$ for all comparisons), and pregabalin use ($p = 0.002$). Compared to the FM group those in the FM-I group had a higher number of clinic visits, and a higher cost per ambulatory visit ($p < 0.001$).

Conclusion: This retrospective study found that, among patients with a diagnosis of fibromyalgia, those with a concurrent diagnosis of insomnia had an elevated number and cost of ambulatory visits.

Huang, C et al. Insomnia Increases Symptom Severity and Healthcare Utilization in Patients with Fibromyalgia: A Population Based Study. **Clin J Pain.** 2019, September; 35(9):780–785.

POSTOPERATIVE WEIGHTBEARING RESTRICTIONS IN ELDERLY HIP FRACTURE

Previous studies have found that, contrary to evidence-based guidelines, less than half of patients are allowed weight-bearing as tolerated after hip fracture surgery. This study assessed the effects of post-operative weight bearing restrictions on subsequent mobility.

This prospective study included patients over 75 years of age with a trochanteric fracture and surgical repair, with intramedullary nailing of the proximal femur. Physiotherapy began on postoperative day one. Those treated before October of 2017 were included in a partial weight bearing (PWB) group while all successive patients were placed in a full weight-bearing (FWB) group.

Mobilization with PWB (less than 20 kg) was instructed for the first 19 patients and mobilization with FWB for the following 22. Pre-fracture and postoperative mobility and activities of daily living were assessed using the Parker Mobility Score (PMS) and the Barthel Index (BI).

The differences between the pre-fracture and postoperative PMS scores were significantly higher (better) in the FWB than in the PWB group ($p < 0.001$). Post-treatment gait analysis revealed significantly higher gait speed in the FWB than in the PWB group ($p = 0.003$). Loading of the affected limb was, on average, 350.25 N peak force in the FWB group, and 353.08 N in the PWB group ($p = 0.918$).

Conclusion: This study of elderly hip fracture patients found that, compared with partial weight-bearing, those allowed full weight-bearing after surgery achieved better mobility.

Pfeufer, D., et al. Weight-bearing Restrictions Reduce Postoperative Mobility in Elderly Hip Fracture Patients. **Arch Ortho Trauma Surg.** 2019, September; 139(9): 1253-1259.

ANKLE FRACTURE IMMOBILIZATION FOR THREE VERSUS SIX WEEKS

After stable Weber B ankle fractures, treatment has routinely included six weeks of immobilization in a cast or an orthosis. This study assessed the effect of immobilization for three and six weeks in a cast or an orthosis, with outcomes reviewed at one year.

Subjects were 247 patients seen in an emergency department for isolated stable Weber B type ankle fractures. The participants were randomized to receive a standard cast applied for three weeks, a commercially available orthotic device applied for three weeks, or a standard cast applied for six weeks. The primary outcome measure was the Olerud-Molander Ankle Score (OMAS) at 52 weeks.

At 52-week follow-up, the mean OMAS scores were 92 in the six-week cast group, 90 in the orthosis group and 88 in the six-week cast group (lower scores indicating more severe symptoms), revealing no statistical difference. At 52 weeks, ankle range of motion did not significantly differ between groups. Fracture nonunion was found in 2.8% of the three-week cast group, zero percent of the three-week orthosis group and six percent of the six-week cast group. Symptomatic deep vein thrombosis was diagnosed in eight patients. These included five in the six-week cast group, three in the three-week cast group and none in the orthosis group ($p = 0.06$).

Conclusion: This study of

patients with stable Weber B type ankle fractures found that immobilization for three weeks was not inferior to cast immobilization for six weeks for bone healing or function at one year.

Kortekangas, T., et al. Three-Week versus Six-Week Immobilisation for Stable Weber B Type Ankle Fractures: Randomised, Multicentre, Non-Inferiority Clinical Trial. *Br Med J*. 2019; 364: k5432.

CARPOMETACARPAL SPLINTING, THUMB PAIN AND PINCH STRENGTH

Osteoarthritis (OA) of the first carpometacarpal (CMC) joint affects up to 11% of men and 30% of women over the age of 50 years. Splinting of the CMC has been found to be effective for decreasing pain, although some question its effect on the functional use of the thumb. This study assessed the effect of CMC splinting on hand function and pain.

Subjects were 14 healthy, right-handed individuals who completed two experimental sessions, two weeks apart. At each session, thumb pain was induced by hypertonic saline injection into the dorsal radial ligament (DRL), located at the base of the first metacarpal bone. Isotonic saline was injected into the contralateral DLR as a control. Isometric tip pinch strength was measured and EMG measures were taken before the injections, after the painful injection and then after the pain resolved.

Post-injection pain was significantly greater in those injected with hypertonic saline than in those injected with isotonic saline ($p < 0.01$). Tip pinch strength decreased after hypertonic saline injection but not after isotonic injection ($p < 0.001$). While wearing the CMC splint, the subjects reported less pain, and demonstrated less reduction in pinch strength compared to the non-splinted condition ($p < 0.05$). The EMG studies revealed that the muscle activity was significantly reduced in the APB and FDI in the non-splinted hand as compared to the splinted hand ($p < 0.05$) and as compared to the isotonic condition ($p < 0.01$).

Conclusion: This study of carpometacarpal joint pain of the thumb found that splinting significantly reduced pain and improved pinch strength.

Ooishi, D., et al. Splinting for the Carpometacarpal Joint Relieves Experimental Basal Thumb Pain and Loss of Pinch Strength. *Euro J*

Pain. 2019, August; 23(7): 1351-1357.

SMOKING AND CARPAL TUNNEL SYNDROME

Cross-sectional studies have suggested that smoking is a risk factor for carpal tunnel syndrome (CTS). This finding has not been evaluated in cross-sectional studies. This study assessed the effect of maternal smoking and offspring smoking on the risk of CTS.

Data were obtained from the Northern Finland birth cohort of 1966. The study originally included 12,231 children with an expected birthdate in 1966. The prenatal data were collected from mothers of 12,065 children. In 1997, 8,719 cohort participants were alive, living in Finland and gave their informed consent to participate in the 31-year assessment. Data from 1981 forward were obtained from the Finnish Care Register for Healthcare, a national register covering both public and private hospitals in Finland. Diagnoses of CTS were obtained from these data. All subjects were asked about their use of tobacco, with prenatal assessments of the subjects' mothers including smoking in the 12 months before pregnancy or during pregnancy.

Prenatal smoking was significantly related to offspring smoking, but not to subsequent CTS. CTS was more prevalent among those with a history of smoking than among those with no such history in both men and women ($p < 0.001$ for both comparisons). Regular smoking of 10 or less pack years by the age of 31 was associated with 1.5-fold increased risk of CTS, while over ten pack years increased the risk to nearly double. Overweight/obesity was associated with a higher risk of CTS in both genders.

Conclusion: This study found that smoking is associated with an increased risk of carpal tunnel syndrome, although no such association was found with prenatal smoking by the mother.

Hulkkonen, S., et al. Smoking as Risk Factor for Carpal Tunnel Syndrome: A Birth Cohort Study. *Musc Nerve*. 2019, September; 60 (3): 299-304.

QUALITY OF LIFE WHILE AWAITING JOINT ARTHROPLASTY

With the aging of the world's population, degenerative joint

disease and the need for joint replacement is increasing. This study evaluated quality-of-life among individuals waiting for a joint replacement.

Subjects were consecutive patients seen for primary total hip arthroplasty (THA) or total knee arthroplasty (TKA) between January of 2014 and September of 2017. Preoperatively, the participants completed the EuroQol Five-Dimension (EQ-5D) general health questionnaire, wherein an EQ-5D of less than zero is defined as a state "worse than death" (WTD). In addition, the patients completed questionnaires including a detailed comorbidity questionnaire, general health questions and a joint specific hip or knee outcome measure.

Participants were seen two weeks before surgery, with demographic data collected concerning body mass index (BMI). At one year postoperatively, questionnaires included a detailed comorbidity questionnaire, general health (EQ-5D), and joint-specific (the Oxford Hip Score (OHS) or Oxford Knee Score (OKS)) measures and a measure of patient satisfaction.

Data were completed for 2,073 patients undergoing THA and 2,168 undergoing TKA. Preoperatively, EQ-5D scores were WTD in 391 (19%) of the THA and 263 (12%) of the TKA patients. Comorbidities identified preoperatively which were independently associated with WTD scores were chronic obstructive pulmonary disease among those undergoing THA and peripheral artery disease and inflammatory arthropathy among those undergoing TKA. At one-year post-surgery, 19 patients had EQ-5D scores within the range of WTD.

Conclusion: This cross-sectional study of patients who were waiting to undergo hip or knee replacement found that quality of life was rated as worse than death in 19% of the hip and 12% of the knee patients.

Scott, C., et al. Worse than Death and Waiting for a Joint Arthroplasty. *Bone Joint J*. 2019; 101-B: 941-950.

BLOOD FLOW RESTRICTION AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

After anterior cruciate ligament reconstruction (ACLR), many individuals do not completely regain their quadriceps strength. While performing resistance exercise at 60 - 80% of the 1RM is ideal for increasing quadriceps strength, high loads are often contraindicated after

ACLR. This study evaluated the efficacy of a blood flow restricted (BFR) weightlifting program to increase quadriceps strength after ACLR.

Subjects were nine patients with ACLR at least two years prior to the study, and nine healthy controls. All ACLR subjects exhibited at least a 10% difference in rectus femoris thickness, vastus lateralis weakness or knee extension strength between the involved and uninvolved legs. All participants completed a home-based exercise program, focusing on the ACLR leg. Exercise involved BFR using a thigh cuff set at 50% of the occlusion pressure. All subjects performed five training sessions per week for four weeks. Thicknesses of the rectus femoris and vastus lateralis were measured at baseline and at follow-up in the involved and uninvolved legs using B-ultrasound. A symmetry index was calculated by comparing the strength and thickness of one leg to the other.

The ACLR group had their surgeries an average of five years prior to the study onset. At follow up, the rectus femoris and vastus lateralis thickness of the involved leg increased by 10% and 11%, respectively ($p < 0.001$). In addition, the knee extensor strength increased by 20%. Strength symmetry significantly improved from baseline to follow up in the ACLR group, with post-training values similar to the controls.

Conclusion: This study of patients with anterior cruciate ligament repair five years earlier found that home-based blood flow restriction exercise significantly increased quadriceps muscle thickness and knee extensor strength and reduced asymmetry between the surgical and nonsurgical legs.

Kilgas, M., et al. Exercise with Blood Flow Restriction to Improve Quadriceps Function Long after ACL Reconstruction. *Int J Sports Med.* 2019, September; 40(10): 650-656.

BLOOD FLOW RESTRICTION AND MOTOR UNIT BEHAVIOR

Previous studies have found that blood flow restriction (BFR) can enhance muscle activation during low intensity exercise. This study assessed whether high threshold motor units with lower firing rates are recruited more effectively following BFR, as compared with non-blood flow restriction exercise.

Subjects were healthy men with an average age of 26 years. All underwent baseline assessments, including strength testing to determine the one repetition maximum (1RM) for knee extension. Each subject was tested under

different conditions of unilateral knee extension, with one condition involving leg extension at 20% of the 1RM and another involving leg extension at 20% of the 1RM during BFR.

Exercises included five sets of 15 repetitions, with 30 seconds of passive rest between sets. Blood flow restriction was set at 60% of arterial occlusion pressure (AOP). Blood flow restriction was sustained for a total of eight minutes per session. During exercise, EMG activity was recorded from the vastus lateralis, with signals analyzed to extract motor unit recruitment threshold, firing rates and action potential amplitudes.

EMG force decrement was seen only after BFR, reduced by 20.5% ($p < 0.05$). The BFR group had increased activity of the motor units with higher motor unit action potential. Those motor units with similar motor unit action potential were activated at higher firing rates in the BFR group.

Conclusion: This study indicates that blood flow restriction during exercise induces a shift in the motor unit recruitment pattern during exercise.

Fatela, P., et al. Blood Flow Restriction Alters Motor Unit Behavior during Resistance Exercise. *Int J Sp Med.* 2019; 40(9): 601-608.

PREOPERATIVE WEIGHT LOSS FOR MORBIDLY OBESE UNDERGOING KNEE ARTHROPLASTY

For patients undergoing total knee arthroplasty, morbid obesity (body mass index (BMI) $>40\text{kg/m}^2$) is associated with numerous concerns, including thirty-day mortality and surgical site infection. This study assessed whether different levels of preoperative weight loss are associated with improved postoperative outcome measures.

This retrospective study included 2,157 patients. For all subjects, BMI was measured 90 days before surgery and then repeated preoperatively. Weight loss in the 90 days before surgery was compared to outcome measures.

Surgery was performed in 203 patients. Of those who lost weight, 41% had lost at least five pounds, 29% had lost at least 10 pounds and 14% had lost over 20 pounds. No significant association was seen between a weight loss of five to 10 pounds and the outcome measures. Those who had lost 20 pounds had a shorter adjusted length of stay, with a mean difference of 0.87 days

($p=0.001$) and a lower rate of discharge to a facility ($p=0.039$).

Conclusion: This study of morbidly obese patients scheduled for total knee arthroplasty found that a weight loss of five to 10 pounds prior to surgery did not impact outcomes, while losing at least 20 pounds was associated with a shorter length of stay and reduced odds of discharge to a facility.

Keeney, B., et al. Preoperative Weight Loss for Morbidly Obese Patients Undergoing Total Knee Arthroplasty: Determining the Necessary Amount. *J Bone Joint Surg Amer.* 2019, August; 101(16): 1440-1450.

INTRANASAL KETAMINE FOR ACUTE PAIN

Ketamine is an N-methyl-D-aspartate receptor antagonist which is widely used as an analgesic agent for the treatment of acute pain. This study assessed the efficacy of intranasal ketamine for reducing pain among individuals undergoing a digital block in the emergency room.

This randomized trial included 100 patients presenting to the emergency department, each of whom required a digital nerve block (DNB). A 100-point visual analog scale (VAS) was used to assess the pain of the nerve block. Before the procedure, the patients were randomized to receive either 50 mg of ketamine intranasally or one mL of normal saline.

Five minutes after the ketamine injection, a standard dorsal webpace digital nerve block was performed, with the patient's VAS pain score assessed and then repeated 45 minutes later. The primary outcome variable was reduction in pain intensity, with secondary outcomes including adverse events.

The median VAS score immediately after the procedure was significantly less in the ketamine group than in the normal saline group ($p < 0.001$). In addition, 45 minutes after the DNB, the VAS pain scores were significantly better in the ketamine group than the placebo group ($p < 0.001$).

Conclusion: This study of patients undergoing digital nerve block found that intranasal ketamine significantly reduced the acute pain of the procedure.

Nejati, A., et al. Intranasal Ketamine Reduces Pain of Digital Nerve Block; A Double-Blind, Randomized, Clinical Trial. *Amer J Emerg Med.* 2019, September; 37:1622-1626.

DOSING OF TRIAMCINOLONE FOR KNEE SYNOVITIS

For patients with rheumatoid arthritis (RA) and psoriatic arthritis (PsA) intra-articular glucocorticoid injections have become a cornerstone of therapy. Triamcinolone hexacetonide (TH) is one of the most commonly used preparations for this treatment, although research has varied in doses tested for patients with RA, from 20 mg to 80 mg. This study compared the clinical treatment outcome of two doses of TH.

Subjects were patients with chronic polyarthritis who were seen at outpatient rheumatology units between 2015 and 2017. Those participants were randomized to receive injections of either 20 mg or 40 mg of TH, with the patient held blind to treatment condition. The subjects were asked to contact the clinic if joint symptoms recurred. If so, the knee was examined again, and, if clinical signs of synovitis were confirmed, a relapse was recorded and the time from injection to relapse was calculated.

Participants included 159 patients, of whom 102 were diagnosed with RA and 57 with PsA. At six-month follow-up, a relapse had been recorded in 30% of the 20 mg group and in 32% of the 40 mg group ($p=0.822$). No significant differences were found between the RA and PsA groups.

Conclusion: This study of patients with rheumatoid or psoriatic arthritis found that the response to knee injections with triamcinolone did not differ between those given 20 mg and 40 mg.

Weitof, T., et al. Dosing of Intra-Articular Triamcinolone Hexacetonide for Knee Synovitis in Chronic Polyarthritis: A Randomized, Controlled Study. *J Rheum.* 2019, March; 48(4); 279-283.

NOCICEPTION AND QUADRICEPS WEAKNESS FOLLOWING TOTAL KNEE ARTHROPLASTY

Total knee arthroplasty (TKA) is widely regarded as effective in reducing osteoarthritis (OA) related knee pain, and is among the most commonly performed surgical procedures in the United States. The surgery is associated with an immediate and profound loss of quadriceps strength within the first few days. This study examined the relationship between quadriceps strength and measures of

nociception.

Data were collected as part of a longitudinal observational study examining recovery after TKA. Subjects included 53 consecutive patients recruited from three different practices. All subjects were tested for muscle strength, muscle activation, and nociceptor sensitization. For the latter, pressure pain thresholds were assessed at the medial joint line and at the ipsilateral arm, with pressure increased until subjects indicated a sensation of pain.

The percent change in activation and the percentage change of quadriceps strength were significantly correlated ($p<0.001$). The knee pressure pain threshold was significantly associated with both change in quadriceps strength ($p=0.001$) and the percentage of change in quadriceps activation ($p=0.001$). Forearm pressure-pain thresholds did not have similar associations.

Conclusion: This study found that local nociceptor sensitization is correlated with reduced strength and muscle activation following total knee arthroplasty.

Loyd, B., et al. Peripheral Nociception Is Associated with Voluntary Activation Deficits and Quadriceps Weakness Following Total Knee Arthroplasty. *JBJS Am* 2019, Sept; 101(17):1539-1545.

SHOE CHARACTERISTICS AND LOWER EXTREMITY INJURIES

Lower extremity musculoskeletal injuries during fitness training are a primary source of injury and disability in the United States military. This study explored the association between shoe characteristics and injury risk among military cadets.

This prospective cohort study included data from 827 participants who were incoming cadets at the United States Military Academy. A baseline questionnaire was used to obtain a comprehensive history of lower extremity injuries. The make, model and length of each participant's right running shoe was recorded, and then assessed for stiffness during torsion. All cadets then underwent nine weeks of basic training with injuries recorded and evaluated at the sports medicine and orthopedic clinics. Lower extremity injuries were defined as injuries occurring during basic training resulting in physical limitations for three days or more. The cumulative incidence of lower extremity injury during basic training

was 18%, with 59% diagnosed as overuse injuries. Subjects wearing shoes with moderate lateral torsional stiffness were 51% less likely to incur a lower extremity injury compared to those wearing shoes with minimal lateral torsional stiffness. In a regression analysis, compared to those wearing shoes with minimal lateral torsional stiffness, those wearing shoes with mild or moderate lateral torsional stiffness were 36% and 49% less likely to sustain a lower extremity injury. In a regression analysis, compared to those wearing shoes with minimal heel height, those wearing shoes with mild heel height were 39% less likely to sustain a lower extremity injury.

Conclusion: This study of military cadets undergoing basic training found that running shoe lateral torsional stiffness and heel height were significant factors in the risk of injury training.

Helton, G., et al. Association between Running Shoe Characteristics and Lower Extremity Injuries in United States Military Academy Cadets. *Am J Sports Med.* 2019, October; 47 (12):2853-2862.

THURSDAY NIGHT FOOTBALL IMPACT ON NFL INJURIES

Since the introduction of Thursday Night Football in the National Football League (NFL), players have publicly opposed the games, citing a lack of proper recovery time from the previous Sunday. As prior studies have shown connections between lack of rest and injury, this study reviewed the effect of the shortened recovery time on injuries sustained during Thursday night games.

Using data published weekly by the NFL between 2012 and 2017, data concerning injuries were collected for every player on all 32 NFL teams. The rate of all-cause injuries was compared between Thursday night games and those played on weekends.

Data were available for 69 Thursday NFL games involving 8,480 players. The all-cause injury rate for weekend games was 7,598 per 1,000 athletic exposures, while that for Thursday night games was 6,072 per 1,000 athletic exposure. The calculated relative risk of injury during Thursday night games compared to weekend games was 0.97.

Conclusion: This study found that injuries during Thursday night football games in the NFL are slightly less than those sustained during play on weekends, with an absolute risk reduction of three

percent.

Baker, H., et al. Thursday Night Football's Impact on All Cause Injuries in NFL Players During 2012 to 2017. *Phys Sportsmed.* 2019; 47 (3): 350-352.

BLOOD FLOW RESTRICTION WITH PROTEIN SUPPLEMENTATION

Mobility decline in older adults results, in part, from a progressive decline of skeletal muscle mass. This study examined the effect of blood flow restriction training with collagen hydrolysate supplementation on muscle mass and function in older men at risk for sarcopenia.

Subjects were 39 healthy men, 50 years of age or older. After a baseline assessment, including physical examination, patients were randomized to a control group (CON), a blood flow restriction group (BFR) or a BFR plus protein (BFR+P) group. The BFR and BFR+P groups underwent lower extremity leg reps with 30 repetitions at 20% of their one rep max followed by three sets of 15 repetitions, three times per week for four weeks. At four weeks the repetitions were increased to 30% of the one rep max. In the BFR group, blood flow was restricted to 50% of each individual's arterial occlusion pressure. Those in the BFR+P group received a daily dose of 15 g of collagen hydrolysate within 60 minutes of completing the exercise. Muscle mass, strength and metabolic parameters were measured at baseline and at follow up.

The cross-sectional area of the thigh increased by 6.7% in the BFR+P, 5.7% in the BFR and 1.1% in the CON group. Isometric strength increased by 10.2% in the BFR+P, 4.8% in the BFR and fell by 5.3% in the CON group. Insulin-like growth factor increased by 15.3 µg/l in the BFR+P, and 10.6 µg/l in the BFR group, and 5.0 µg/l in the CON group.

Conclusion: This study demonstrates that protein, added to blood flow restriction exercise, may accelerate muscle gains in elderly individuals.

Centner, C., et al. Effects of Protein Supplementation on Muscle Mass and Strength in Older Men. *J Sports Sci Med.* 2019, September; 18 (3):471-478.

MODIC CHANGES AND LONG-TERM PAIN

Modic changes (MCs) are often found in radiographic studies of patients with low back pain (LBP). This study reviewed the association between MCs and long term physical disability, back pain, and sick leave.

This study included patients 18-60 years of age, recruited in 2004-2005 with LBP with back greater than leg pain. The original study randomized patients to cognitive training or physiotherapy, finding no difference at one year. This 13 year follow up included 170 of 207 patients from the original study. Patients were split into two groups based on lumbar MRI evidence of Modic changes; MC group (n=67) and non-MC (n=122) group. The primary outcomes were disability, using the Roland-Morris Disability Questionnaire (RMQD) an activity limitations survey, low back pain, and number of sick leave days used in the past year due to back pain.

At 13 year follow-up the RMQD scores were significantly better in +MC group than in the -MC (p=0.024). In addition, activity limitations were significantly lower in the +MC group (p=0.012), with the + MC group taking a fewer number of sick days due to back pain (p=0.003).

Conclusion: This study of patients with low back pain found that those with Modic changes noted on MRI had less long-term pain, disability, or sick leave than did those without Modic changes.

Udby, P., et al. Modic Changes Are Not Associated with Long-Term Pain and Disability: A Cohort Study with 13-year Follow-up. *Spine.* 2019 Sept; 44(17):1186-1192.

CAUSES OF OSTEOARTHRITIS

Osteoarthritis (OA) is the most common form of arthritis in developed countries. While a number of factors are associated with OA, causal factors are less clear. Noting that Mendelian randomization (MR) can be used to test for a causal association between a risk factor and a particular outcome, this study used MR to better understand casual factors for site-specific OA in the complete UK Biobank data set.

Subjects were 502,647 individuals between the ages of 37 and 76 years recruited from across the United Kingdom from 2006 to 2010. Baseline data included health status, demographics, and lifestyle, with physical examinations for

anthropometric measures, blood pressure, and bone mineral density. The primary outcome measure was OA, defined by hospital diagnosis. To assess causal association, genetic instrument variables obtained from published genome-wide association study (GWAS) meta-analysis were used to assess the possible causality of BMI, femoral neck and lumbar spine BMD, serum HDL cholesterol, LDL cholesterol, and triglyceride levels, type 2 diabetes, systolic BP and CRP levels.

The data revealed three factors (high BMI, high femoral neck BMD, and low systolic BP) that were causally associated with an increased risk of OA. High BMI was shown to be causal for knee and hip OA, but not hand OA. A high femoral neck BMD was causally associated with the risk of knee OA and hip OA. In addition, low systolic BP was causally associated with all OA.

Conclusion: This study found that high BMI, high femoral neck BMD, and low systolic BP are causally associated with an increased risk of OA.

Funck-Brentano, T., et al. Causal Factors for Knee, Hip and Hand Osteoarthritis: A Mendelian Randomization Study in the UK Biobank. *Arthritis Rheumatol.* 2019, October; 71(10):1635-1641.

DISORDERED SLEEP AND LOW BACK PAIN

It has been estimated that up to 84% of all individuals will have low back pain (LBP) at some point in their lives. As sleep quality has been associated with reduced pain tolerance, this study assessed the effect of a sleep disorder on LBP and healthcare utilization.

Subjects were patients at a large US military hospital with LBP who were referred for a one-time pain self-management class. Baseline data included self-reported disability, pain intensity and sleepiness with assessments including the Oswestry Disability Index, a pain intensity question from the Oswestry Disability Index, and sleepiness using the Epworth Sleepiness Scale.

Subjects were 758 individuals who participated in the self-management class. The number of health care visits for LBP was significantly associated with pain intensity (p < 0.01), disability (p < 0.001), and history of sleep disorder (p < 0.001). Health care costs for LBP were significantly associated with pain intensity (p < 0.01), disability (p < 0.001), and history of sleep disorder (p < 0.001). Higher disability and the presence of a

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sleep disorder were independently associated with higher health care visits.

Conclusion: This study of patients with low back pain found that higher disability, pain intensity, and the presence of a sleep disorder were associated with higher clinic visits and costs for LBP.

Rhon, D., et al. Does Disordered Sleep Moderate the Relationship Between Pain, Disability and Downstream Health Care Utilization in Patients with Low Back Pain? **Spine** 2019; 44 (21):1481-1491.

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