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INTRAVENOUS THROMBOLYSIS IN PATIENTS WITH LACUNAR INFARCTS

Alteplase (tPA) is approved for the treatment of acute ischemic stroke, regardless of stroke subtype. However, its benefit in patients with lacunar infarcts is often debated. The goal of this trial was to investigate the efficacy and safety of intravenous thrombolysis in patients with lacunar infarcts.

The WAKE-UP trial was a multicenter, double-blind, placebo-controlled, randomized clinical trial that ran from September of 2012 to June of 2017. The study enrolled 503 patients to investigate the efficacy of intravenous thrombolysis with alteplase in patients with acute ischemic stroke of unknown time of onset. This post-hoc analysis focused on the subset of patients who had sustained an acute lacunar infarct (n=108). The primary outcome measure was a favorable outcome, as defined by a modified Rankin Score (mRS) of zero or one.

Of 108 patients with lacunar infarctions, 55 were assigned to the treatment group and 53 to the placebo group. At follow-up, there was a nonsignificant difference between groups in NIHSS scores with a median of five in the alteplase group and four in the placebo group (p=0.09). The authors note that, as the WAKE-UP trial was not powered to show a significant treatment outcome in subgroups of patients, appropriately powered studies are needed to further explore this treatment for patients with lacunar strokes.

Conclusion: This subgroup analysis of the WAKE-UP trial suggests that treatment with alteplase is of similar benefit in patients with lacunar infarcts as in those with other stroke subtypes.

Barow, E., et al. Functional Outcome of Intravenous Thrombolysis in Patients with Lacunar Infarcts in the WAKE-UP Trial. **JAMA Neurol.** Published online March 25,

2019. doi:10.1001/jamaneurol.2019.0351.

PEDALING BASED REHABILITATION FOR TOTAL KNEE REPLACEMENT

While pedaling is often prescribed after total knee replacement (TKR), no prior trials have assessed the efficacy of this exercise in the acute, postoperative setting. This study compared a pedaling protocol with a non-pedaling protocol, commencing within 24 hours of surgery.

Subjects were adults with osteoarthritis, undergoing unilateral TKR. Beginning the day of surgery patients began therapy for 20 minutes, twice per day, randomized either to a pedaling group or a traditional exercise group. The pedaling group used a stationary pedaling protocol seated at a set of floor pedals. The standard care group engaged in a 10-exercise program, including seated knee bends, inner range quadriceps strengthening and functional exercises. The primary outcome measure was the six-minute walk test, with secondary outcomes including the timed up and go (TUG) test, the 10m-walk test (10MWT) and maximum knee flexion.

The distance covered in the six-minute walk test was significantly greater in the pedaling group at two days postoperatively (p<0.001). Though statistically insignificant, further improvement was noted at two and four months. A similar pattern was found for the secondary outcomes of the 10MWT and TUG tests, in favor of the pedaling-based group at two days (p=0.016 and p=0.020, respectively), but not at two weeks or four months. The hospital length of stay was one half day shorter for the pedaling group (p = 0.024).

Conclusion: This randomized, controlled trial found that a pedaling-based physical therapy protocol after total knee replacement is superior to a multi-exercise protocol for mobility

improvement, with a significantly shorter length of stay.

Sattler, L., et al. Pedaling-Based Protocol Superior to a 10- Exercise, Non-Pedaling Protocol for Postoperative Rehabilitation after Total Knee Replacement. **J Bone Joint Surg.** 2019, April 17; 101(8): 688-695.

HYPOTENSIVE EFFECT OF WATER-BASED EXERCISE

By some estimates, by the year 2015, 16.7% of the world's population will be over the age of 65 years. As water-based exercise has been showed to promote blood pressure control, this study reviewed the effects of heated water-based exercise for the management of blood pressure in the elderly.

The participants were sedentary adults over the age of 60, each with a diagnosis of primary systemic hypertension. The subjects were randomized to perform 30 minutes of moderate intensity exercise, either walking in the pool (P), walking on a treadmill (T) or participating in a nonexercised control (C) group. Using a randomized crossover intervention protocol, subjects underwent baseline evaluations of blood pressure, heart rate, carotid-femoral pulse wave velocity, and endothelial reactivity, measured at baseline, and then immediately after exercise. Ambulatory 24-hour blood pressure monitoring included 15-minute daytime and 20-minute nighttime blood pressure checks.

Heart rate was significantly lower in the P than in the T group at four minutes (p=0.03), ten minutes (p=0.05), 12 minutes (p=0.02), and at 18 to 30 minutes of exercise (p<0.01). Systolic blood pressure (SBP) increased by 18 mmHg immediately after the P condition but reduced during recovery to lower than baseline (p<0.01). The SBP increased after T but reduced to levels equivalent to baseline during recovery. At the 24-hour blood

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pressure evaluation daytime systolic pressure load was significantly lower in the P group than in the C group ($p < 0.05$) while diastolic pressure load was lower after the P condition than after both the T and the C conditions ($p < 0.05$).

Conclusion: This study found that heated water-based exercise in older individuals with hypertension could reduce heart rate during and blood pressure after exercise.

Ngomane, A., et al. Hypotensive Effect of Heated Water-Based Exercise in Older Individuals with Hypertension. *Int J Sports Med.* 2019, April; 40(4):283–291.

BODY MASS INDEX AND STROKE TYPE RISK

As a positive association has been established between body mass index (BMI) and ischemic stroke, this Chinese study was designed to assess the age and sex associated relationship between total, ischemic and hemorrhagic stroke.

This study cohort included 3906 adults in 18 low income farming villages in China. The baseline investigation was performed in October 1991 with stroke events recorded until February of 2018. Demographic characteristics, medical history, and lifestyle habits were recorded with physical examinations including blood pressure height and weight. A BMI was calculated with the subjects divided into underweight ($< 18 \text{ kg/m}^2$) normal weight ($18\text{--}23.9 \text{ kg/m}^2$), overweight ($24\text{--}27.9 \text{ kg/m}^2$), and obese ($\geq 28 \text{ kg/m}^2$). All first-ever strokes were documented, with subarachnoid hemorrhages and transient ischemic attacks excluded.

During follow-up, 638 strokes occurred, including 404 ischemic, 121 hemorrhagic and 113 undefined strokes. For those < 65 years of age, compared to those with normal BMI, the adjusted hazard ratio (HR) associated with being overweight at baseline was 1.69 for any stroke ($p < 0.001$), 1.42 for ischemic stroke ($p = 0.002$), and 2.35 for hemorrhagic stroke ($p < 0.001$). Underweight was associated with hemorrhagic stroke ($p = 0.002$). Obesity was significantly associated with total ($p < 0.001$) and ischemic ($p < 0.001$) stroke. These associations were stronger in women than in men. However, among individuals aged ≥ 65 years, there was no correlation between BMI and stroke, regardless of type.

Conclusion: This prospective study of Chinese farmers followed for

27 years found that for those under 65 years of age, an elevated body mass index increased the risk of total, ischemic and hemorrhagic stroke. No association was found for those 65 years of age and older.

Gu, H., et al. Age and Sex Associated Impacts of Body Mass Index on Stroke Type Risk: A 27 Year Prospective Cohort Study in a Low-Income Population in China. *Front Neurol.* 2019, May 1. <https://doi.org/10.3389/fneur.2019.00456>

CYTOTOXICITY OF JOINT INJECTIONS

It is estimated that 10% of the global population over the age of 60 years have significant clinical problems attributable to osteoarthritis (OA). Treatments for OA include injections of local anesthetics (LA), glucocorticoids (GC), hyaluronic acid (HA) and tranexamic acid (TA). This study investigated the cytotoxic effects of LA, GC, HA and TA.

Cartilage and tenocytes were harvested from three healthy donors, ages 58 to 74 years, undergoing total knee arthroplasty. The cells were exposed to lidocaine hydrochloride 1%, bupivacaine 0.5%, triamcinolone acetonide, dexamethasone, TA, iodine contrast media, HA, normal saline or distilled water. Each was presented in a different solution with cell numbers determined after exposure.

Compared with normal saline, cytotoxic effects for chondrocytes and tenocytes were noted at a dilution of 1:2 with exposure to lidocaine, bupivacaine, triamcinolone and iodine contrast. For dexamethasone, cytotoxicity was detected only for chondrocytes at a dilution of 1:2. Exposure to hyaluronic acid did not affect cell numbers at any dilution. With dilution, chondrocyte cytotoxicity was noted with GC at 1:10, as well as LA at 1:10 and 1:100. Tenocyte cytotoxicity was found with LA and triamcinolone acetonide at a dilution of 1:10. At a dilution of 1:100, none of the investigated drugs showed any cytotoxic effects.

Conclusion: This study found that the cytotoxicity of intra-articular injected drugs towards chondrocytes and tenocytes depends upon the concentration of the drug, with local anesthetics most toxic and hyaluronic acid least toxic.

Busse, P., et al. Cytotoxicity of Drugs Injected into Joints in Orthopedics.

ULTRASOUND DIAGNOSIS OF PIRIFORMIS SYNDROME

Piriformis syndrome (PS) is a controversial, yet commonly seen, diagnosis for hip and buttock pain. MRI has been the preferred imaging method for evaluation of the piriformis, although ultrasound (US) provides a potentially cheaper and quicker option. This study compared US and MRI for the examination of piriformis syndrome.

This cross-sectional study evaluated 33 patients with a clinical diagnosis of PS and 26 healthy controls. The subjects were assessed by clinicians held blind to the clinical diagnosis, using US and MRI. Evaluations were made of piriformis muscle thickness, cross-sectional area (CSA), echogenicity and signal intensity on T2-weighted images.

Comparative studies of both the MRI and US found that the piriformis muscle was thicker on the symptomatic than on the asymptomatic side in patients with PS, with no significant difference between sides in the controls. In addition, CSA and echogenicity were significantly different between the symptomatic and the asymptomatic piriformis muscles in the PS patients, with no significant difference in controls.

Conclusion: This study suggests that ultrasound may be an effective tool to assist with the diagnosis of the PS.

Zhang, W., et al. Ultrasound Appears to be a Reliable Technique for the Diagnosis of Piriformis Syndrome. **Musc Nerve.** 2019, April; 59 (4): 411-416.

COMPOUNDED TOPICAL PAIN CREAM FOR CHRONIC PAIN

In 2014, the National Defense Authorization Act mandated an examination of payments through Tricare for compounded medications. The report found that Tricare pharmacy benefits program paid \$259 million for compounded medications in 2013, increasing to \$746 million in 2014. Similar increases were noted by the Centers for Medicare and Medicaid services. This study assessed the efficacy of compounded topical pain creams for pain relief and functional improvement.

This double-blind, randomized, parallel study compared active topical pain formulas with placebo for three types of chronic pain, including neuropathic, nociceptive and mixed. Subjects were 399 adults with localized pain, with an average pain score of four on a 10-point numerical rating scale. Pain was categorized by reviewing historic and examination findings, imaging results and other relevant diagnostic tests. The subjects were separated by pain category and were randomized to receive a placebo cream or a compounded formula, specific for that pain category.

Those with predominantly neuropathic pain received creams with ketamine, gabapentin, clonidine and lidocaine. Those with nociceptive pain received ketamine, baclofen, cyclobenzaprine and lidocaine, and those with mixed pain disorder received ketamine, gabapentin, diclofenac, baclofen, cyclobenzaprine and lidocaine. The creams were applied three times per day, with follow-up at one month to assess pain scores and function.

The change in pain scores at one month did not differ between the placebo and the compound groups for any pain classification group. Positive satisfaction at one month was noted in 43% of the treatment groups and 28% of the placebo group, though this did not reach statistical significance.

Conclusion: This study of patients with chronic, localized pain did not find that compounded creams are effective in reducing pain.

Brutcher, R., et al. Compounded Topical Pain Creams to Treat Localized, Chronic Pain. A Randomized, Controlled Trial. **Ann Int Med.** 2019, March 5; 170: 309-318.

OLFACTION AND MORTALITY

While olfactory impairments affect up to 25% of older adults, this often goes unrecognized. This study was design to better understand the relationship between olfaction and all-cause mortality.

Healthy well-functioning community dwelling individuals, ages 70 to 79 years, were enrolled in 1997-1998, and followed until 2014 with annual clinic or home visits. The 12 item Brief Smell Identification Test was administered to 2289 subjects at the 1999 or 2000 visit. Health and survival were monitored through

hospitalization and health surveillance for up to 13 years after the smell test.

During 13 years of follow-up, 1211 participants died. Poor olfaction was significantly associated with higher all-cause mortality at 10 and 13 years. Compared to those with good olfaction those with poor olfaction had a 46% higher risk of death at 10 years and a 30% higher risk at 13 years. For the group who reported excellent to good health at baseline, poor olfaction was associated with a 62% higher all-cause mortality at year 10 and a 40% higher all-cause mortality at year 13, while no association was found among those who reported fair to poor health at baseline.

Conclusion: This study suggest that poor olfaction is associated with worse long-term mortality among older adults, especially those with excellent to good health at baseline.

Liu, B., et al. Relationship between Poor Olfaction and Mortality among Community Dwelling Older Adults. **Ann Intern Med.** 2019; doi:10.7326/M18-0775.

FLUIDOTHERAPY FOR POST-STROKE COMPLEX REGIONAL PAIN SYNDROME

Complex regional pain syndrome (CRPS) is characterized by spontaneous or stimulus-induced pain which is disproportionate to the initiating event, accompanied by autonomic abnormalities. Trauma is thought to be the most common precipitating factor. As CRPS has been reported in over 20% of stroke survivors, this study assessed the efficacy of fluidotherapy as a treatment modality.

Subjects were selected from 200 patients at an inpatient rehabilitation hospital, seen between April of 2014 and March of 2015. Of these patients, 42 were diagnosed with unilateral CRPS type I, occurring after the stroke. Data were obtained for associated demographics, clinical characteristics, functional capacity, spasticity as well as sensory and motor deficits. The patients were randomly divided into two groups. All patients received therapy five days a week for two to four hours per day. Those in the treatment group received 15 sessions, five times per week, of fluidotherapy to the affected arm at 40°C for 20 minutes.

At post-treatment evaluation, significant improvements were noted in all patients in edema volume, Brunnstrom motor recovery

assessment of the upper extremity and hand, FIM scores, pain visual analog scale scores and pain DETECT scores. Those in the treatment group had significantly greater reductions in edema volume and pain DETECT scores, as compared to the control group ($p < 0.05$). Among the measures of sensory deficits, the rates of hyperalgesia and allodynia significantly decreased only in the fluidotherapy group ($p = 0.01$ and $p = 0.02$, respectively).

Conclusion: This study of patients with post-stroke complex regional pain syndrome found that the use of fluidotherapy can significantly accelerate recovery of edema, pain, hyperalgesia and allodynia.

Ozcan, D., et al. The Effectiveness of Fluidotherapy in PostStroke Complex Regional Pain Syndrome: A Randomized, Controlled Study. *J Stroke Cerebrovasc Dis*. doi.org/10.1016/j.jstrokecerebrovasdis.2019.03.002.

ASPIRIN PROPHYLAXIS AFTER HIP OR KNEE ARTHROPLASTY

Venous thromboembolism (VTE) can be a serious complication following hip and knee joint replacement surgery. A number of pharmaceutical and nonpharmaceutical interventions have been used to reduce the risk of these events. This literature and meta-analysis were designed to better understand the efficacy of aspirin as prophylaxis for hip or knee arthroplasty.

A literature search was completed for randomized controlled trials which compared aspirin with another prophylactic intervention after knee or hip arthroplasty. The primary outcome was venous thromboembolism.

The authors included 13 randomized controlled trials including 20,115 patients with a mean age of 67.15 years. Aspirin dosing varied from 81 mg to 1200 mg per day with time of treatment spanning from 14-35 days. Aspirin use was associated with a significant reduction of VTEs compared with placebo ($p = 0.008$) and a non-significant reduction of VTEs compared with other strategies (relative risk 0.87; $p = 0.43$). There were no significant differences between all groups in mortality, major bleeding and all bleeding events.

Conclusion: This meta-analysis of randomized controlled trials involving patients undergoing hip or

knee arthroplasty found that the use of aspirin resulted in a significant reduction of VTE events compared to placebo, with no difference found between aspirin and other interventions.

Haykal, T., et al. Aspirin for Venous Thromboembolism Prophylaxis after Hip or Knee Arthroplasty: An Updated Meta-analysis of Randomized Controlled Trials. *J Orthop*. 2019, July-August; 16(4): 312-319.

REGAINING PREFRACTURE MOBILITY AND POST-DISCHARGE MORTALITY

Despite enhanced recovery programs, patients undergoing surgery for hip fractures (HFs) continue to have a high rate of morbidity and mortality. This population-based, cohort study assessed the association between the return to prefracture basic mobility status at the time of discharge and 30-day, post-discharge mortality and readmission.

Subjects were Danish patients, 65 years or older, all undergoing a first-time HF during the year 2015. The data were harvested from the Danish Multidisciplinary HF Database (DMHFD), a national database that monitors the early basic mobility status of patients with HF at the time of acute hospital discharge. During hospitalization, all patients were assessed with the Cumulative Ambulation Score (CAS). The primary outcome variables (mortality or any readmission within 30 days of discharge) was compared between those who had returned to baseline CAS (Baseline CAS) and those who had not (Impaired CAS).

Of the 5,147 patients, 2,050 (40%) regained the baseline CAS and 3,097 did not. An adjusted analysis revealed that 30-day mortality was 2.8 times higher in the Impaired CAS group than in the Baseline CAS group. In the adjusted analysis, compared with the Baseline CAS group, the hazard ratio for readmission within 30 days was 1.26 for the Impaired CAS group.

Conclusion: This study of patients hospitalized for hip fracture found that those who regained baseline mobility had a reduced mortality rate and risk of readmission within thirty days, as compared to those discharged with a reduced basic mobility.

Kristensen, M., et al. Regaining Pre-Fracture Basic Mobility Status after

Hip Fracture and Association with Post-Discharge Mortality and Readmission—a Nationwide Register Study in Denmark. *Age Aging*. 2019; 48: 278-284.

VIBRATION FOAM ROLLING AFTER EXERCISE-INDUCED MUSCLE DAMAGE

Foam Rolling (FR) is a self-administered therapeutic technique that requires that an individual lie on a round or tubular device, slowly rolling the affected body area over the roller. As vibration during exercise has shown some therapeutic benefit, this study compared the effects of FR with vibration (VFR) with non-vibrating FR (NVFR) on DOMS.

Thirty-eight adults, free from musculoskeletal disorders, were randomized to a VFR or a NVFR group. After baseline measurements, the subjects participated in 10 sets of 10 repetitions of parallel squats using a gravity-free training flywheel, with maximal effort at each repetition. At baseline, and at 48 hours post-exercise, measurements were made of pain, using a visual analog scale (VAS), pain pressure threshold, oxygen saturation, muscle performance and hip and knee range of motion. The treatment technique included three, 60-second bouts of roller massage, applied to each leg, with a 30-second rest between sets, using either VFR or NVFR vibration.

Compared to the NVFR group, resting VAS was reduced by 30.2% in the VFR group ($p < 0.05$), with pain during exercise or stretching better in the VFR group, although this finding did not reach statistical significance. For measures of passive hip joint extension, compared to the NVFR, the ROM in the VFR group was 9.3% greater ($p < 0.05$).

Conclusion: This study of exercise induced muscle soreness found that, when using the foam roller technique for recovery, adding vibration may enhance the results.

Romero-Moraleda, B., et al. Effects of Vibration and Non-Vibration Foam Rolling on Recovery after Exercise with Induced Muscle Damage. *J Sports Sci Med*. 2019; 18: 172-180.

LEUKOCYTE ESTERASE TEST FOR PERIPROSTHETIC JOINT INFECTION

Periprosthetic joint infections are one of the more complex complications of total joint

arthroplasty (TJA). As the diagnosis of such infections can be complicated by recent antibiotic administration, this study evaluated the diagnostic utility of the synovial leukocyte esterase strip test.

Records were reviewed of all patients who had undergone hip or knee arthroplasty at the authors' facility from October 2009 to 2014. Of those undergoing a revision surgery for suspected periprosthetic joint infection, 32% had taken antibiotics within two weeks of the diagnostic workup. Lab tests included the leukocyte esterase strip test, the serum erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), synovial fluid white blood cells (WBC) and synovial effusion fluid polymorphonuclear neutrophil (PMN). The results of these laboratory tests were compared with the final diagnosis of infection.

The recent administration of antibiotics was found to significantly reduce the sensitivity of all laboratory tests except the leukocyte esterase strip test ($p < 0.05$). With recent antibiotic treatment, the sensitivity of the most accurate lab tests, in descending order were: ESR 79.5%, leukocyte esterase 78%, and WBC 69.3%.

Conclusion: This study of patients undergoing joint replacement revision found that the administration of premature antibiotics can compromise the results of standard diagnostic tests for periprosthetic joint infection, with the leukocyte esterase test most able to maintain its diagnostic performance.

Shahi, A., et al. The Leukocyte Esterase Test for Periprosthetic Joint Infection is Not Affected by Prior Antibiotic Administration. *J Bone Joint Surg.* 2019, April 17;101 (8):739-744.

PROLONGED OPIOID USE AFTER SHOULDER ARTHROSCOPY

The United States consumes 80% of the global opioid supply. As long-term opioid dependence may be triggered by a period of opioid use for acute pain, this study assessed the risk of long-term use after rotator cuff surgery.

Health claims were reviewed from the Truven Health Market Scan Research Databases (50 million employees and Medicare patients). Data from 2010 to 2015 were reviewed for shoulder arthroscopic procedures among opioid naïve adults. Data were recorded for

demographics, comorbidities, and postoperative opioid use. The primary outcome measure was prolonged opioid use, defined as more than one opioid prescription within 90 -100 days after the surgical event.

During the study timeframe, 31,768 patients undergoing an arthroscopic procedure filled an opioid prescription within the 30 days of surgery. Of these 8,686 patients (8.3%) developed new prolonged opioid use, as defined in this study. The factors associated with the highest odds ratio of prolonged use included a total opioid dose during the perioperative period of over 743 oral morphine equivalents (>149 tablets of 5-mg hydrocodone), followed by a self-harm disorder, a history of alcohol dependence or abuse, mood disorder and an opioid prescription filled within 30 days before surgery, female gender, anxiety disorder or a history of a pain diagnosis.

Conclusion: This study of adults undergoing arthroscopic shoulder procedures found that, of opioid naïve patients, 8.3% developed new, prolonged opioid use (refilled the prescription).

Gil, J., et al. Risk of Prolonged Opioid Use among Opioid-Naïve Patients after Common Shoulder Arthroscopic Procedures. *Am J Sports Med.* 2019, April; 47(5): 1043-1050.

LEUKOCYTE RICH PLATELET RICH PLASMA FOR GLEUTEUS TENDINOPATHY

Gleuteal tendinopathy is thought to be one of the primary causes of lateral hip pain. As recent data suggests that leukocyte rich platelet rich plasma (LR-PRP) injections can effectively treat tendinopathy, this study assessed the effect of this intervention on chronic gleuteal tendinopathy.

The subjects were 80 patients 60 years of age or older, all with chronic gleuteal tendinopathy. Each participant had radiologically confirmed grade II or III tendinopathy (no tear). The subjects were randomized to receive either PR-PRP or a corticosteroid injection (CSI) placed into the tendon under ultrasound guidance. The primary outcome measure was the Modified Harris Hip Score (mHHS), completed at baseline and at two, six and 12 weeks and at six, 12 and 24 months follow up. At 12 weeks those who requested further treatment were

allowed to crossover to the other treatment.

The mean mHHS at 12 weeks in the PRP group was 74 and 67 in the CSI group ($p=0.48$). At 24 weeks this difference widened in favor of the LR-PRP group with mHHS of 77.6 in the LR-PRP group and 65.72 in the CSI group ($p=0.0002$). The efficacy of the steroid injections decreased after 12 weeks while the effect of the LR-PRP was sustained at two years.

Conclusion: This study of patients with chronic gleuteal tendinopathy found that intra-tendon injections with LR-PRP resulted in significantly better improvement than did corticosteroid injections at up to two years.

Fitzpatrick, J., et al. Leucocyte Rich Platelet Rich Plasma Treatment of Gluteus Medius and Minimus Tendinopathy. A Double Blind Randomized Controlled Trial with 2 Year Follow-Up. *Am J Sports Med.* 2019, May; 47 (5): 1130-1137.

SURVIVAL AFTER A NONTRAUMATIC SPINAL CORD INJURY

The prevalence of non-traumatic spinal cord injuries (NTSCI) is expected to rise with the aging of the population. This study was designed to better understand the long-term outcomes of patients with NTSCI.

Data were harvested from the Swiss Spinal Cord Injury Medical Record study, which covers all specialized rehabilitation centers for SCI in Switzerland. Data were obtained for patients 16 years of age or older, with NTSCI identified between 1990 and 2011. Diagnostic categories included degenerative disc disorders, infection, vascular disorders, benign tumors, malignant tumors, unspecified tumors and other. Other medical information, including level of injury, was documented.

Data were completed for 1,450 patients, of whom 59% were male, 65.3% were paraplegic and 87.2% were diagnosed with incomplete cord lesions. Those with malignant and unspecified tumors had the steepest decline in five-year survival, compared with all other etiologic groups. Compared with degenerative disc disease, the mortality was significantly greater for those with malignant and unspecified tumors, (hazard ratio [HR] 6.32).

For those with malignant lesions, the one-year survival probability for those with complete paraplegia was 20.9%, dropping to 9.2% after five

years. Those with a nonmalignant etiology had a survival probability of 69.9% after one year, diminishing to 45.6% after five years. Among males at least 60 years of age, malignant etiology was associated with 1.7 life years remaining, compared with 10.1 for those with nonmalignant etiologies and 12.9 for those with degenerative disc etiology.

Conclusion: This observational, cohort study of patients with spinal cord injury found that life expectancy estimates were different among etiologic groups.

Buzzell, A., et al. Survival after non-Traumatic Spinal Cord Injury: Evidence from a Population-Based Rehabilitation Cohort in Switzerland. **Spinal Cord**. 2019; 57:267–275.

EFFECT OF COMBINED AEROBIC AND COGNITIVE TRAINING ON FLUID INTELLIGENCE AFTER STROKE

A window of recovery exists after a stroke, with cohort studies suggesting that motor recovery plateaus at about 12 weeks. This study was designed to assess whether aerobic exercise, combined with cognitive training, can improve fluid intelligence.

Subjects were adult patients discharged from rehabilitation hospitals after treatment for stroke. All participated in therapy for 50 to 70 minutes, three times per week, for 10 weeks. Interventions included 20 to 30 minutes of physical intervention (aerobic or stretching) and 20 to 30 minutes of cognitive intervention (dual task training or games). The participants were randomized to groups, including aerobic plus cognitive (AE+C), aerobic plus games (AE+G), activity plus cognitive (A+C) training and activity plus games (A+G), considered the control group.

Aerobic exercise was performed at 60-80% of peak oxygen uptake. Cognitive training included computerized dual-n-back training, adapted to the individual's performance. A working memory task involved monitoring a series of two, concurrent stimuli. Cognitive games occurred at a workstation using a non-adaptive, computer-based game, involving puzzle pieces. The primary outcome variable was fluid intelligence/abstract reasoning, as measured with the Raven's Progressive Matrices Test (RPMT).

At 12-week follow-up, improvement in the RPMT from baseline was significant in the AE+C (48.8%) and increased in the A+G (20.7%) groups, compared with

seven percent improve in the AE+G and a decline of a 0.5% in the A+G groups ($p=0.032$). Measures of the brain derived neurotrophic factor were not predictive of outcome.

Conclusion: This study of patients discharged from stroke rehabilitation found that aerobic exercise, combined with cognitive training, improves fluid intelligence by nearly 50% at six months post-stroke.

Ploughman, M., et al. Synergistic Benefits of Combined Aerobic and Cognitive Training on Fluid Intelligence and the Role of IGF-1 in Chronic Stroke. **Neurorehab Neural Repair**. 2019, March; 33 (3): 199-212.

EFFECTS ON COGNITION OF CONCUSSION WITH LOSS OF CONSCIOUSNESS AND ATTENTION DEFICIT DISORDER

Among the factors thought to influence recovery from concussion are a diagnosis of attention-deficit/hyperactivity disorder (ADHD), as well as a history of a previous concussion with loss of consciousness (LOC). This study was designed to better understand the influence on ImPACT testing of self-reported ADHD and history of LOC.

Data were collected from 1,460 adult college students who underwent pre-participation ImPACT cognitive testing. Past medical history included a diagnosis of ADHD and a concussion with LOC.

Of the 1,460 participants, 168 (11.5%) reported a previous diagnosis of ADHD and 408 (27.9%) reported a previous concussion, with 27.4% of these reporting a history of concussion with LOC. The analysis of variance for ImPACT composite scores found a statistically significant main effect for those diagnosed with ADHD ($p=0.014$) as well as for concussion history ($p=0.016$). Those with history of non-LOC concussion performed better on visual/motor speed than both those who reported history of concussion with LOC ($p=0.023$) and those with no history of concussion ($p=0.001$). Those with a previous diagnosis of ADHD reported more symptoms than did those without ADHD. Total symptom scores were higher for those with a history of concussion resulting in LOC than for those with a previous concussion absent of LOC ($p=0.003$), as well as those with no history of any concussion ($p<0.001$).

Conclusion: This study of college athletes found a history of ADHD and concussion with a loss of

consciousness may negatively influence symptoms and neurocognitive performance.

Kaye, S., et al. Baseline Neurocognitive Performance and Symptoms in Those with Attention Deficit Hyperactivity Disorders and History of Concussion with Previous Loss of Consciousness. **Front Neurol**. 2019, April;10:396.

PLANT-BASED DIETS AND ADIPOSITY OVER TIME

As diet is an important, modifiable lifestyle variable determining body fat, this study reviewed prospective cohort data from the Rotterdam study, to assess the effect of plant-based diets on adiposity.

The Rotterdam study began in 1990 with participants 55 years of age or older, with additional cohorts added in the years 2000 and 2006. Diet was assessed at baseline using a food frequency questionnaire, with a plant-based diet index used to assess the degree of adherence to a plant-based diet. Repeat measurements of adiposity were performed at a median follow-up of 7.1 years.

Adherence to a plant-based diet was associated with lower body mass index (BMI) ($p<0.0001$), waist circumference ($p<0.0001$), fat mass index ($p<0.0001$) and body fat percentage ($p<0.0001$). Compared to those in the questionnaire results, lowest quintile of the plant-based diet, those in the highest had a median 4.1 cm lower waist circumference, and a 1.3 kg/m² lower BMI.

Conclusion: This Rotterdam based study found that higher adherence to a plant-based diet was associated with lower body mass index and waist circumference over time.

Chen, Z., et al. Plant-Based Diet and Adiposity Over Time in a Middle-Aged and Elderly Population. The Rotterdam Study. **Epidemiol**. 2019, March; 30(2):303-310.

STRUCTURAL REORGANIZATION OF THE BRAIN IN MIGRAINE

Studies of patients with migraine have failed to demonstrate whether there is a progressive component to its pathophysiology. This study was designed to better understand the evolution of the pathophysiology of migraine.

Subjects were 36 patients with episodic migraine without aura and 33, age-matched, healthy controls.

All underwent T1-weighted magnetic resonance imaging (MRI) scans using the tensor-based morphometry method (TBM). These were used to review regional tissue shrinkage or expansion in relation to the average template. Functional MRI images were used to characterize the brain's functional activity into functional networks.

Compared with normal subjects, those with chronic migraine without aura had a reduced volume in the medial prefrontal cortex. Among the 375 functional brain networks reviewed, resting state clinic activity was decreased in the migraine patients between two components, spanning the visual cortex, posterior insula and the parietal somatosensory cortex.

Conclusion: This study of patients with migraine without aura reveals structural and functional alterations of the brain.

Soheili, S., et al. Structural and Functional Reorganization of the Brain in Migraine Without Aura. *Front Neurol.* 2019. doi: 10.3389/fneur.2019.00442

SPINAL MANIPULATION FOR CHRONIC LOW BACK PAIN

Spinal manipulative therapy (SMT) treatment of chronic low back pain (cLBP) is considered a first line treatment option in some countries, while others recommend it as a component of a broader treatment package. This literature review and meta-analysis was designed to better understand the effectiveness of SMT for pain relief and functional improvement among patients with chronic low back pain.

Data were reviewed for randomized controlled trials (RCTs) which included adults with cLBP, compared with a control group, allowing for the assessment of the isolated effect of SMT. Outcomes were assessed at one, three, six, and 12 months post-randomization, with data analyzed according to the time closest to these intervals. The primary outcomes were defined as short term (one month), intermediate term (six months), and long term (12 months).

From the studies reviewed, 47 RCTs were included in this analysis. Those trials which compared SMT to traditional therapies, demonstrated significantly better pain relief at six (p=0.009) but not at 12 months (p=0.21). In addition, compared to traditional therapies, improved function was noted at one (p=0.003)

but not at six (p=0.14) or 12 months (p=0.18).

Conclusion: This literature review and meta-analysis suggests that, for patients with chronic low back pain, spinal manipulative therapy is more effective than traditional therapies at six months for pain relief, and at one month for functional improvement.

Rubenstein, S., et al. Benefits and Harms of Spinal Manipulative Therapy for the Treatment of Chronic Low Back Pain: Systematic Review and Meta-Analysis of Randomized, Controlled Trials. *Br Med J.* 2019; 364: 1689.

ACETABULAR CARTILAGE WEAR IN FEMOROACETABULAR IMPINGEMENT

Acetabular cartilage damage has been found in 70% to 88% of patients undergoing hip arthroscopy for the treatment of femoroacetabular impingement (FAI). This study assessed patterns of cartilage wear in patients with symptomatic FAI.

Subjects included 3,578 patients undergoing surgical procedures between January 2009 and November 2016 for the treatment of symptomatic FAI. At surgery, radiographs were obtained and operative findings recorded. The Beck classification was used to classify cartilage damage.

Subjects included 802 patients of whom 58% had a diagnosis of cam FAI, 36% with a diagnosis of combined FAI and six percent with pincer FAI. Acetabular cartilage wear was identified in 93% and femoral head cartilage wear in 16%. More frequent and severe debonding of acetabular cartilage was found in patients with symptomatic cam FAI (93%) and mixed (97%) FAI as compared with pincer (75%) FAI of the hip (p < 0.001). Those with pincer FAI most commonly demonstrated cartilage lesions with an even distribution at the anterior and superolateral acetabular rim. Age and body mass index kg/m² were independent risk factors for cartilage wear at the femoral head (p<0.001 and p=0.0006 respectively)

Conclusion: This study found significant associations between acetabular patterns of wear and FAI hip pathologies.

Pascual-Garrido, C., et al. The Pattern of Acetabular Cartilage Wear Is Hip Morphology-Dependent and Patient Demographic-Dependent. *Clin Orthop Relat Res.* 2019, May; 477(5):1021-1033.

A-FIB AND BRAIN MRI FINDINGS

Previous studies have identified an association between atrial fibrillation (AF) and cognitive decline, independent of stroke. The ARIC study (Atherosclerosis Risk in Communities) evaluated the association between incident AF and longitudinal change in brain morphology.

This prospective community-based cohort study included men and women 45-64 years of age. Physical exams were completed and covariates recorded including age, race, sex, study center, education, occupation, cigarette smoking, body mass index, hypertension, diabetes mellitus, prevalent coronary heart disease, prevalent congestive heart failure, and anticoagulant use. An ECG and MRI were obtained at both evaluations, with changes between the 1993 and 2004 visits compared by AF status at follow up.

Of the 969 participants, 35 had AF at the 2004-2006 evaluation. Compared to those without AF those with AF had a higher odds ratio of higher sulcal grade (p=0.04), greater odds of a higher ventricular grade (p=0.03), and subclinical cerebral infarctions (p=0.006), all of which are associated with advanced aging and dementia. AF was not associated with white matter hyperintensities or total brain volume.

Conclusion: This longitudinal study demonstrated that atrial fibrillation is correlated with a worsening of MRI brain findings independent of stroke.

Berman, J et al. Atrial Fibrillation and Brain Magnetic Resonance Imaging Abnormalities. *Stroke.* 2019, April; 50(4): 783-788.

TROPONIN LEVEL IN ISCHEMIC STROKE PATIENT

Among patients with acute ischemic stroke, a positive serum troponin level has been associated with cardioembolic stroke subtypes. This study investigated the association between troponin levels and the presence of other visceral infarctions.

Data were abstracted from a stroke registry, including consecutive patients with a discharge diagnosis of ischemic stroke. Those with a clinically indicated contrast-enhanced computerized tomography (CT) of the abdomen and pelvis within one year of the stroke were assessed for visceral infarcts. The primary

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outcome was visceral infarction of the kidneys or spleen. These results were compared with troponin levels, with covariates including age, sex, history of hypertension, diabetes, hyperlipidemia, coronary heart disease, atrial fibrillation, prior transient ischemic attack or stroke, congestive heart failure, and active smoking.

Of the 1233 patients with ischemic stroke, 259 had a CT of the abdomen and pelvis. Of these 237 had a serum troponin level drawn on admission. Of these with 17.3% were positive. The baseline characteristics of patients with and without a qualifying CT were similar. Patients with a positive troponin level were more likely to have a visceral infarct (39.1%) than were those without a positive troponin level (15%) with this association persisting after adjusting for confounding variables ($p=0.008$).

Conclusion: This study of patients hospitalized for ischemic stroke found that an elevated troponin level on admission is associated with visceral infarcts.

Azher, I et al. Serum Troponin Level and Acute Ischemic Stroke Identifies Patients with Visceral Infarcts. *J Stroke Cerebrovasc Dis.* 2019, May; 28 (5): 1173–1177.

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