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RADIOFREQUENCY ABLATION FOR CHRONIC KNEE PAIN

Previous studies have suggested that radiofrequency ablation of the geniculate nerve may be effective for the treatment of pain due to osteoarthritis (OA) of the knee. Some have proposed that pain relief may be greater with cooled radiofrequency ablation (CRFA). This retrospective study examined "real-life" data demonstrating the effects of CRFA for a heterogeneous group of patients treated for OA of the knee.

Consecutive patients seen for OA of the knee between July 2014 and July 2017 were eligible for inclusion. Baseline data included a visual analog scale (VAS) for pain. The CRFA procedure included sensory stimulation at 50 Hz, conducted at less than 0.5 V, for reproduction of the target pain, followed by ablation at a temperature of 60°C. All procedures were completed under sedation, using a 17-gauge cooled RF introducer under fluoroscopic visualization. Pain scores were obtained before and after treatment. The use of pain medications was followed over time.

The average baseline CRFA pain score improved from 8.5/10 cm to 4.2/10 cm after treatment. A total of 65% of the patients had at least a 50% reduction in pain scores. The mean duration of at least 50% pain relief was 12.5 months. There was, however, no significant decrease in opioid use during that time.

Conclusion: This study of patients with chronic pain due to osteoarthritis of the knee found that cooled radiofrequency ablation resulted in significant and long-lasting pain relief.

Kapural, L., et al. Long-Term Retrospective Assessment of Clinical Efficacy of Radiofrequency Ablation of the Knee Using a Cooled Radiofrequency System. **Pain Physician.** 2019, September; 22(5): 489-494.

NEURODEGENERATIVE DISEASE AMONG FORMER PROFESSIONAL SOCCER PLAYERS

Concerns have been raised about the risk of neurodegenerative disease among participants in contact sports. This study explored the mortality from neurodegenerative disease among former professional soccer players.

Data were obtained from the electronic Data Research and Innovation Service of the National Health Service of Scotland. Electronic health records were accessed to obtain data on death certification and medications typically prescribed for the treatment of dementia in a cohort of former professional soccer players. These medical records were matched in a 1:3 ratio with controls from the general population.

Data from 7,676 former professional soccer players were matched with 23,028 controls. The median age of death of the soccer players was 67.9 years while that of the controls was 64.7 years ($p < 0.001$). However neurodegenerative disease as a primary cause of death was 1.7% among former soccer players and 0.5% among matched controls ($p < 0.001$). Neurodegenerative disease was recorded as primary or a contributor to the cause of death in 2.9% of soccer players and 1% of controls ($p < 0.001$).

Conclusion: This Scottish study of former professional soccer players, found that, compared to controls, soccer players lived longer but had a higher rate of neurodegenerative disease as a cause of death.

Mackay, D., et al. Neurodegenerative Disease Mortality among Former Professional Soccer Players. **N Engl J Med.** 2019, Nov 7; 381(19):1801-1808.

CONCUSSION SYMPTOMS AND TESTOSTERONE LEVELS

Some have suggested that erectile dysfunction (ED) and pituitary

hormone deficiencies may be long-term sequelae of traumatic brain injury. This study examined the association between football-related concussion symptoms and subsequent medication recommendations for low testosterone levels or ED in a large cohort of former professional football players.

The Football Players Health Study recruited men who played for the National Football League after 1960. All were sent questionnaires asking about concussions during their careers. Of 13,724 players, 25.6% had responded as of March of 2017. The questionnaires asked about the frequency of concussions, with responses categorized as none, once, two to five times, six to 10 times or 11 times or more. All subjects were asked about the symptoms that they experienced with each concussion. The participants were further asked whether a medical provider had ever recommended medication for low testosterone or ED.

Among the 3,409 participants, 18.3% reported indicators of low testosterone and 22.7% reported indicators of ED. An adjusted analysis revealed an association between concussion symptoms and indicators of low testosterone levels, as well as ED (OR 3.49 and OR 2.41, respectively). A fully adjusted model, with concussion symptoms and loss of consciousness as continuous variables, found both to be significantly associated with low testosterone levels and ED ($p < 0.001$ for both comparisons).

Conclusion: This study of former professional football players found that a history of concussion was associated with current low testosterone and erectile dysfunction.

Grashow, R., et al. Association of Concussion Symptoms with Testosterone Levels and Erectile Dysfunction in Former Professional U.S.-Style Football Players. **JAMA Neurol.** 2019; 76 (12): 1428-1430.

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COUNTY LEVEL INCREASES IN STROKE MORTALITY

Recently, the declining trend in national stroke death rates has reversed, particularly among adults 35 to 64 years of age. The biggest increases were noted among states in the South Census Region, where stroke death rates experienced a significant increase between 2013 and 2015. This study was designed to better understand the geography of these changes.

Using data from the National Vital Statistics System, the authors identified the annual number of deaths attributed to stroke among adults 35 years of age or older. Data were reviewed in each U.S. county during 2010- through 2016, in order to estimate the annual county level death rates for stroke.

From 2000 to 2016, nationally, the total percent of change among middle age adults 35 to 64 years of age was -0.7%, while that among older adults over 65 years of age was -3.5%. However, at the county level, the median change in stroke-related death rates increased by 3.1% for the middle-aged group and 9.1% for the older age group.

Increasing stroke death rates were more widespread among the middle-aged adult group, with 56.6% of U.S. counties experiencing an increase in stroke death rates, as compared with 26.1% of counties among older adults.

Conclusion: This study found that over half of the counties in the U.S. experienced an increase in stroke mortality for the middle aged between 2000 and 2016.

Hall, E., et al. Stagnating National Declines in Stroke Mortality Mask Widespread County-Level Increases, 2010-2016. **Stroke.** 2019, December; 50(12): 3355-3359.

STATINS AFTER ISCHEMIC STROKE IN YOUNG ADULTS

Among patients who sustain an ischemic stroke (IS) at a young age, one in three will experience recurrent vascular events. As HMG-CoA reductase inhibitors (statins) have been associated with a reduced risk of death, recurrent stroke and other vascular events in older populations, this study examined their effect in young adults with IS.

Subjects were consecutive patients, 15 to 49 years of age, each with first-ever IS, and all treated at the Helsinki University Hospital from January of 1994 to May of 2007. The

National Institutes of Health Stroke Scale was used to assess stroke severity at admission. Medical information and socioeconomic data were recorded for each subject. Those who filled statin prescriptions at least twice during follow-up were compared to those who did not. The two groups were then compared for vascular events during a follow-up period of 8.3 years.

Of the 935 patients followed in the study, 46.8% used statins. A univariate analysis revealed that statin users had lower all-cause mortality (HR 0.38) and recurrent stroke (HR 0.29). A multivariate analysis confirmed this advantage. Separating the analysis by etiology of the index stroke, statin use was found to be associated with a lower recurrence of stroke among those with large artery atherosclerosis (HR 0.25), all other causes of ischemic stroke (HR 0.39) and embolic strokes of unclear sources (HR 0.26).

Conclusion: This study of young patients with ischemic stroke found that statin use was associated with a lower risk of all-cause mortality and recurrent stroke, but that less than half used statins after their stroke.

Van Dongen, M., et al. Use of Statins after Ischemic Stroke in Young Adults and its Association with Long-Term Outcome. **Stroke.** 2019, December; 50(12): 3385-3392.

LIPIDS AND ISCHEMIC STROKE

Many studies have identified a positive association between total cholesterol (TC) and ischemic stroke (IS), although some have noted only a weak relationship. This prospective, cohort study was designed to further understand the effect of lipids on the occurrence of stroke.

Subjects were participants from six studies in China, with baseline studies conducted between 1970 and 2007. Baseline data included gender, age, smoking status, alcohol consumption and physical examination data, including lipid levels. The subjects were followed for a stroke event, fatal or nonfatal. The participants were divided into five groups by levels of total cholesterol (TC): < 120, 120-159.9, 160-199.9, 200-239.9 and > 240. Other lipids were similarly categorized.

The subjects included 267,500 adults, of whom 5,458 developed IS and 2,186 developed hemorrhagic strokes. A multivariable adjusted analysis revealed that the hazard ratios (HRs) for IS per 1 mmol/liter

increases in TC, LDL-C, HDL-C and triglycerides were 1.08, 1.08, 0.84 and 1.07, respectively. A significantly greater risk of hemorrhagic stroke was noted for patients with lower TC levels ($p=0.002$) and lower HDL levels ($p<0.001$).

Conclusion: This Chinese study supports a positive association between ischemic stroke and total cholesterol, LDL cholesterol and triglycerides, while the risk of hemorrhagic stroke is increased with low total cholesterol and triglycerides.

Gu, X., et al. Association of Lipids with Ischemic and Hemorrhagic Stroke. A Prospective, Cohort Study among 267,500 Chinese. **Stroke**. 2019, December; 50(12): 3376-3384.

TRANSCRANIAL DIRECT CURRENT STIMULATIONS AND PACEMAKERS

Transcranial direct current stimulation (tDCS) has been shown to be a promising ancillary treatment for patients with depression, stroke, neurodegenerative diseases and pain. Despite the lack of data, contraindications to the use of tDCS have often included the presence of a pacemaker. This study was designed to better understand the effect of tDCS on the function of a pacemaker.

Seven participants with nondependent bipolar pacemakers and complaints of subjective memory impairment were treated with tDCS. During the treatment, all were monitored by EKG and oxygen saturation monitors. The tDCS was administered for 30 minutes at two mA, using one of three different montages: 1) the anode over the left dorsolateral prefrontal cortex (DLPFC) and the cathode over the right deltoid, 2) the anode over the right DLPFC and the cathode over the left deltoid and 3) the cathode over the left DLPFC and the anode over the right deltoid. After the final session, the pacemakers were interrogated.

During all sessions, there were no abnormalities in EKG or O_2 saturations. After the third stimulation session, the pacemaker interrogation revealed no abnormalities or changes in the programming.

Conclusion: This study of patients with cardiac pacemakers found that transcranial direct current stimulation had no ill effects on pacemaker function.

Roncero, C., et al. Investigation into the Effect of Transcranial Direct Current Stimulation on Cardiac

Pacemakers. **Brain Stim**. 2020, Jan-Feb; 13(1): 89-95.

TRANSCRANIAL DIRECT CURRENT STIMULATION AND LOW BACK PAIN

Chronic low back pain (CLBP) is a common disorder, often resistant to effective treatment strategies. Transcranial direct current stimulation (tDCS) is a noninvasive brain stimulation technique which has shown benefits in treating patients with various pain disorders. This study evaluated the efficacy of tDCS on pain intensity among patients with CLBP.

This prospective, double-blind, randomized, sham controlled study recruited patients, 18 to 65 years of age, each with nonspecific CLBP. All subjects received 20 minutes of either real or sham tDCS. Pain intensity was measured by a Numerical Rating Scale (NRS) and low back muscle activity assessed using topical EMG, both before and after the treatment session. For both the tDCS and sham groups, the anode dry electrode was placed over the C3/C4 position and the cathode over M1. The tDCS was applied at a constant current of 2mA and was delivered for 20 minutes.

Data were gathered for 26 patients who received tDCS and 25 receiving sham tDCS. NRS scores decreased from 5.1 to 3.34 in the DCS group ($p<0.001$) and from 4.6 to 4.36 in the sham group ($p=0.670$). EMG data revealed no difference between groups.

Conclusion: This study of patients with chronic low back pain found that a single episode of transcranial direct current stimulation could reduce back pain severity.

Jiang, N., et al. Effect of Dry, Electrode Based, Transcranial, Direct Current Stimulation on Chronic Low Back Pain and Low Back Muscle Activities: A Double-Blind, Sham Controlled Study. **Restor Neurol Neurosci**. 2020. 10.3233/RNN-190922.

TRANSCRANIAL DIRECT CURRENT STIMULATION FOR MULTIPLE SCLEROSIS

Those diagnosed with multiple sclerosis (MS) have a risk of neuropathic pain that is over five times that of the general population. This study assessed the effect of transcranial direct current stimulation (tDCS) on the symptoms of pain,

fatigue and depression among patients with MS.

This double-blind, sham controlled, randomized study included moderately disabled women with relapsing-remitting MS. The patients were randomized to receive either active or sham tDCS stimulation. Each group was provided five daily sessions at 20 minutes per session. Those in the active group received tDCS at 2 mA, applied over M1. Baseline and follow-up evaluations included the Fatigue Severity Scale (FSS), the Visual Analog Scale (VAS) for pain and the Beck Depression Inventory.

After five days of treatment, those in the active tDCS group had less knee extensor fatigability ($p=0.038$), less perception of fatigue (FSS, $p=0.026$) and decreased pain (VAS, $p=0.025$). No significant changes were noted from day one to day five in depression scores.

Conclusion: This study of patients with relapsing remitting multiple sclerosis found that five days of treatment with transcranial direct current stimulation improved symptoms of fatigue, pain and fatigability.

Workman, C., et al. Transcranial Direct Current Stimulation (tDCS) for the Treatment of a Multiple Sclerosis Symptom Cluster. **Brain Stimul**. 2020, January-February; 13: 263-264.

STATINS AND FRACTURES IN OLDER ADULTS

Previous studies have suggested an association between statin treatment and the risk of fractures, though significant methodologic problems have produced diluted conclusions. This meta-analysis was designed to better understand whether statin therapy is associated with reduced fractures among older individuals.

This literature search included studies published through January 2019 that explored the association between statin use and the risk of osteoporosis. The inclusion criteria were observational studies as well as randomized controlled trials.

The literature search produced 21 observational studies and two randomized controlled trials including 1,783,123 subjects over 50 years of age. Pooling the 21 observational studies, the use of statins was found to reduce the risk of fracture, with a relative risk (RR) of 0.8. The use of statins was significantly associated with a reduced risk of hip fracture (RR

0.73), and lower extremity fracture (RR 0.69), but not others. The risk reduction was stronger for men (RR 0.75), than for women (RR 0.87). When comparing the different statins, only atorvastatin demonstrated the reduced risk (RR 0.84).

Conclusion: This meta-analysis of studies comparing statin use and risk of fracture in the elderly, found a significant association between statin use and fracture reduction.

Shi, R et al. Effects of Statins on Relative Risk of Fractures for Older Adults: An Updated Systematic Review with Meta-analysis. **JAMDA**. 2019, December; 20(12):1566-1578.

LUMBAR ARTIFICIAL DISCS

In the past decade, lumbar total disc replacement has been found to be safe and effective for the treatment of lumbar discogenic low back pain. This study compared the five-year outcomes of patients treated with a new more mobile disc, the activL, with those treated with the ProDisc-L (control).

This prospective, multicenter, randomized, controlled trial included patients with pain and dysfunction due to degenerative disc disease at a single symptomatic level. The participants were randomized to receive an activL or a ProDisc-L. Treatment success was defined as improvement on the Oswestry Disability Index of at least 15 points, maintenance or improvement in neurologic status, maintenance or improvement in range of motion and freedom from repeat surgery.

In the 324 patients, no difference was found between the groups in the primary, composite event at five years. At five years, the activL group had greater ROM for flexion-extension rotation ($p=0.02$) and flexion-extension translation ($p=0.03$), as compared with the control (ProDisc-L) group. Freedom from a serious adverse event through five years was 64% in the activL patients and 47% in the ProDisc-L group ($p=0.0068$).

Conclusion: This long-term follow-up of patients with degenerative disc disease found that a new artificial disc, the activL, produce similar improvement in pain to that with the ProDisc-L, with superior range of motion seen in the activL group.

Yue, J., et al. Five-Year Results of a Randomized, Controlled Trial for Lumbar Artificial Discs in Single-Level Degenerative Disc Disease. **Spine**.

2019, December 15; 44 (24): 1685-1696.

PULSED RADIOFREQUENCY FOR CHRONIC LUMBOSACRAL PAIN

Pulsed radiofrequency (PRF) was developed as an alternative to continuous radiofrequency for the treatment of pain disorders. This study evaluated the efficacy of high-voltage PRF in the treatment of lumbosacral radicular pain with neuropathic features.

Subjects were 41, consecutive, adult patients with single leg radiating pain, unresponsive to conservative treatment. The patients were randomized to receive a placebo or active PRF for two cycles of 240 seconds each, at two Hz, with voltage at 65 to 80 V. This treatment was followed by adhesiolysis (EA), performed with injection of hyaluronidase, 900 units, and betamethasone, eight mg, with a total volume of five ml. The control group underwent EA only. The primary outcome variable was pain intensity, measured with a Numerical Rating Scale (NRS) score. Secondary outcomes included the Oswestry Disability Index and the McGill Pain Questionnaire.

At one-month follow-up, 57% of the patients in the PRF-EA group experienced pain reduction of at least 50%, as compared with 25% in the EA group. At six months, 48% in the PRF-EA group reported continued improvement, compared with only 10% in the EA group.

Conclusion: This study of patients with chronic, lumbosacral, radicular pain found that high-voltage pulsed radiofrequency may be effective in reducing pain.

Vigneri, S., et al. Electrocatheter-mediated, High-Voltage Pulsed Radiofrequency of the Dorsal Root Ganglion in the Treatment of Chronic Lumbosacral Neuropathic Pain. A Randomized, Controlled Study. **CI J Pain**. 2020, January; 36(1): 25-33.

NECK PAIN AND VERTIGO

Neck pain and vertigo often occur simultaneously. Previous studies have shown a bidirectional segmental nerve fiber connection between the cervical spine and sympathetic ganglia. This paper reports on two studies; a retrospective study of vertigo in patients who were treated with a cervical lamina block therapy, and a prospective animal study.

The retrospective study included 90 patients with vertigo and neck pain, randomized to a treatment or a control group. All were treated with a vasodilator. Those in the treatment group underwent a cervical lamina block. Outcome measures included the Dizziness Assessment Rating Scale (DARS), and the Visual Analog Scale (VAS) to assess changes of vertigo and neck pain symptoms. Ultrasound was used to measure bilateral vertebral artery flow. The prospective study included 98 rabbits randomized to a control group or to one of seven treatment groups, one with stimulation at each of the C2 through C8 spinal ganglion ($n = 27$ in each group). Animals in each experimental group then received either normal saline solution or phentolamine (an adrenergic blocker). The exposed ganglion received electric stimulus at 10V, frequency 30 Hz, and duration of five minutes. Vertebral artery flow was measured before and after stimulation.

In the retrospective control group, 81% reported significant improvement using the vasodilator only. Among those receiving a laminar block 89.6% demonstrated improvement in vertigo symptoms, though this did not meet statistical significance either in the VAS or the DARS. The treatment group had significant fewer hospital stays ($p=0.000$). In the animal study, a change in VA blood flow was noted with stimulation of the ipsilateral C2 to C3 or C6 to C8 spinal ganglia ($p = 0.011$ and $p= 0.002$), but not the C4 or C5. The block with phentolamine significantly inhibited this decrease of basilar artery (BA) flow.

Conclusion: This study of patients with cervical pain and vertigo found a potential connection between the cervical spinal and sympathetic ganglia and suggests that the adrenergic system may serve as a possible neurotransmitter.

Zhu, X., et al. Functional Pathway Between Cervical Spinal and Sympathetic Ganglion: A Neurochemical Foundation Between Neck Pain and Vertigo. **Pain Physician**. 2019;22: E627-E633.

LOW INTENSITY RESISTANCE AFTER HEAT STRESS

As studies have found that heat stress can induce muscle hypertrophy, this study evaluated the effect of low intensity resistance training when heat stress is applied prior to training.

Subjects were 30, healthy, male volunteers, assigned to resistance training at 30% of their one-repetition maximum, with three sets of eight repetitions, three days per week for six weeks. Those randomly assigned to a heat stress group underwent a 20-minute application of a hot pack, heated to 75°C, and placed on the dominant upper arm. This process was completed just prior to the resistance training. The thickness of the triceps brachial muscle was measured using ultrasound at baseline and at follow-up.

No significant change was noted in the one-repetition maximum or muscle thickness ($p=0.289$) in the control group. However, in the heat stress group, a significant improvement was seen in both muscle strength ($p=0.003$) and muscle thickness ($p=0.012$).

Conclusion: This study of patients undergoing low intensity resistance training found that heating a muscle with a hot pack prior to resistance training resulted in greater increases in muscle thickness and strength.

Nakamura, M., et al. The Effect of Low Intensity Resistance Training after Heat Stress on Muscle Size and Strength of Triceps Brachii: A Randomized, Controlled Trial. **BMC Musculoskelet Disord.** 2019, December 12; 20: 603.

SHOULDER ADHESIVE CAPSULITIS

Adhesive capsulitis (AC) occurs when excessive fibrous tissue and adhesions are formed across the glenohumeral joint, resulting in pain and restricted motion. While several interventions have been used for AC, there is no evidence-based consensus concerning the most effective treatment. This systematic review and meta-analysis was designed to compare the efficacy of various pharmacological treatment options.

Medical literature was reviewed for studies of adult patients with adhesive capsulitis that compared at least two pharmacological interventions, including oral and injected. The data analysis included subjects from 30, randomized, controlled trials.

Patients in the 30 selected trials were 789 males and 1,343 females. In the studies that focused on short-term outcome, compared with controls, intra-articular corticosteroid injections and distention with corticosteroids resulted in significantly

greater improvement in pain scores than seen in the control condition. In the one trial that included ultrasound-guided rotator interval injection, this intervention was superior to all others. In studies looking at outcomes at two to six months, rotator-interval injection was superior to placebo. For composite outcomes, multiple-site corticosteroid injections were superior to placebo.

Conclusion: This meta-analysis of interventions for adhesive capsulitis found that intra-articular corticosteroid injection, administered alone or after distention of the shoulder capsule, was effective in providing pain relief.

Kitridis, D., et al. Efficacy of Pharmacological Therapies for Adhesive Capsulitis of the Shoulder: A Systematic Review and Network Meta-analysis. **Am J Sports Med.** 2019, December; 47 (14): 3552-3560.

SPHENOPALATINE GANGLION STIMULATION FOR CLUSTER HEADACHE

An important component of the pathophysiology of acute cluster headache attacks is the activation of the trigeminal-autonomic reflex, which accounts for cranial autonomic features. This study explored the efficacy of sphenopalatine ganglion stimulation for the treatment of acute episodes of cluster headaches.

This randomized, double-blind, sham controlled study was completed at 21 headache centers in the United States. Subjects were adults with chronic cluster headaches. The participants were randomized to either active or sham sphenopalatine ganglion stimulation, using an implanted stimulator with a remote-control activator. The patients were asked to use the hand-held remote-control to activate the stimulator for at least 15 minutes for each episode. The primary outcome variable was the proportion of cluster attacks for which pain relief was achieved 15 minutes after the onset of stimulation.

Data were collected for 45 patients in the stimulation group and 48 in the control group. The stimulation group was more likely to have pain relief from attacks of 15 minutes than the control group (odds ratio [OR] 2.62; $p=0.008$). The treatment group was also more likely to have freedom from pain at 15 minutes ($p=0.04$), and sustained pain relief at one hour ($p=0.004$) than the control group. During the study, 512 adverse events were reported by 92 participants, the most common of

which were numbness, pain, swelling, headache, paresthesias, bruising, trismus, tenderness, taste alterations and restricted jaw movement.

Conclusion: This study of patients with chronic cluster headaches found that a surgically implanted sphenopalatine ganglion stimulator could reduce the pain of a headache episode.

Goadsby, P., et al. Safety and Efficacy of Sphenopalatine Ganglion Stimulation for Chronic Cluster Headache: A Double-Blind, Randomized, Controlled Trial. **Lancet Neurol.** 2019; 18: 1081-1090.

BALANCE TRAINING AFTER HIP FRACTURE

Hip fractures in the elderly can significantly impact the ability to maintain independence. The effect of balance training for patients recovering from hip fracture is unknown. This meta-analysis explored the effect of this intervention on recovery after fracture of the hip.

A literature review was completed for studies of patients with hip fracture, with intervention including balance training, and functional outcomes. From this search, nine studies were chosen, all published between 1997 and 2018, including a total of 872 patients.

Patients receiving balance training had significantly better post-operative function than controls ($p=0.001$). In addition, compared to controls, gait speed was better among those in the balance training group ($p=0.005$), as were lower limb strength ($p=0.000$), activities of daily living ($p=0.000$), performance task scores ($p=0.000$) and health-related quality of life scores ($p=0.000$).

Conclusion: This meta-analysis found that balance training after a hip fracture can improve outcomes and quality of life.

Wu, J., et al. Efficacy of Balance Training for Hip Fracture Patients: A Meta-analysis of Randomized, Controlled Trials. **J Orthop Surg Res.** 2019; 14: 83.

KINESIOTAPE AND DRY NEEDLING FOR NECK PAIN

Neck pain is thought to be a major public health problem, with a lifetime prevalence of over 40%. Mechanical neck pain is defined as generalized neck pain and/or shoulder pain with mechanical features, aggravated by neck posture, movement, or

palpation. This study assessed the efficacy of treatment with kinesiotope and dry needling for the symptoms of mechanical neck pain.

Patients presenting with mechanical neck pain were randomly assigned to receive either dry needling or kinesiotope therapy. Both groups were taught home-based exercises. The dry needling intervention focused on tender points identified on physical examination. These points were needled six to eight times, with sessions performed once a week for four weeks. The kinesiotope was applied to the area of the C3-6, stretched at 15% to 25% of its original length. Evaluations were made with the numeric rating scale (NRS) and the Short Form-36 Quality of Life Scale (SF-36).

At follow-up, both the dry needling and kinesiotope groups reported significant improvement in pain, depression and quality of life ($p=0.0001$ for all). In addition, the kinesiotope group demonstrated increased cervical range of motion ($p<0.05$).

Conclusion: This uncontrolled study of patients with mechanical neck pain found that both dry needling and kinesiotope can improve pain, quality of life and depression.

Onat, S., et al. Effect of Dry Needling Injection and Kinesiotaping on Pain and Quality of Life in Patients with Mechanical Neck Pain. **Pain Physician.** 2019, November; 22(6): 583-589.

PROGRESSIVE RETURN TO ACTIVITY AFTER CONCUSSION

For patients with concussion current best practices recommend a progressive return to activity (PRA). The Defense and Veterans Brain Injury Center developed a PRA clinical recommendation (CR) to assist primary care physicians with the management of patients with concussions. This study of military personnel assessed the effectiveness of the Defense and Veterans Brain Injury Center's Progressive Return to Activity Clinical Recommendation (PRA-CR).

Primary care managers caring for patients with concussion were recruited. Eligible patients sustained a concussion within 72 hours of the evaluation and were ineligible if they had a history of moderate or severe TBI. The study compared the recovery patterns of patients who receive treatment for concussion either before or after the clinic began using the PRA-CR. All underwent

assessment with the Neurobehavioral Symptom Inventory (NSI).

The total NSI scores, as well as the cognitive and affective subscores were significantly better in the PRA-CR group than in the control group, when measured at one week, one month, and three months ($p<0.05$ for all comparisons). The significance had disappeared at six months.

Conclusion: This study of military personnel with acute concussions demonstrated that a progressive return to activity, encouraged by the primary care providers, may accelerate symptom recovery.

Baillie, J., et al. Use of the Progressive Return to Activity Guidelines May Expedite Symptom Resolution after Concussion for Active Duty Military. **Am J Sports Med.** 2019, December; 47 (14): 3505–3513.

PROJECTED PREVALENCE OF OBESITY

Studies have demonstrated an increasing prevalence of obesity across United States. This study used the Behavioral Risk Factor Surveillance System (BRFSS), an annual, nationally representative telephone survey of more than 400,000 adults, to project the prevalence of BMI in the United States through the year 2030.

The BRFSS data from 1993 through 1994 and 1999 through 2016, were collected for all 50 states and Washington DC. These data were adjusted to align with objectively measured BMI distributions from the National Health and Nutrition Examination Survey (NHANES) study. The body mass index (BMI) categories were defined according to the Center for Disease Control and Prevention. Historical trends were reviewed and projections made of the prevalence of each BMI category from 1990 through 2030.

The authors calculated that the national prevalence of adult obesity and severe obesity will rise to 48.9% and 24.2% respectively by the year 2030. The prevalence of obesity will rise above 50% in 29 states by 2030 and will not be below 35% in any state. By 2030 severe obesity will be the most common BMI category nationwide among women, black non-Hispanic adults, and adults with a household income of less than \$50,000.

Conclusion: This study estimated that by the year 2030 the prevalence of obesity in the United States will be

nearly 50%, and that over 24% of the population will be severely obese.

Ward, Z., et al. Projected US State Level Prevalence of Adult Obesity and Severe Obesity. **N Engl J Med.** 2019, December 19; 381(25):2440–2450.

ORTHOSTATIC HYPOTENSION AND COGNITIVE FUNCTION IN THE ELDERLY

Orthostatic hypotension (OH) is defined as a reduction of systolic blood pressure at least 20 mmHg or diastolic blood pressure at least 10 mmHg within three minutes of standing. This study assessed the impact of OH on all domains of cognitive function over time in patients 50 years or older.

Data were gathered from the Tubingen Risk Evaluation for Neurodegenerative Diseases (TREND), a prospective longitudinal study initiated in 2009. The subjects were 50-80 years of age without neurodegenerative diseases at baseline. All received a large assessment battery. Orthostatic function was assessed during lying, and at 30, 90, 150, and 210 seconds of active standing. Cognition was assessed with the German version of the extended CERAD-Plus neuropsychological battery. Those with OH were compared to those without.

Of the 495 subjects, 17.6% presented with OH at baseline (OH+). Compared to the OH- the OH+ cohort had worse CERAD performance scores at baseline ($p<0.001$) and a more rapid deterioration in scores over time ($p<0.001$), as well as in subtests of memory function. In addition, compared to the OH- the OH+ group had a higher vascular burden index ($p<0.001$), a higher prevalence of hypertension ($p=0.003$), and a higher prevalence of obesity ($p=0.009$).

Conclusion: This study of patients 50 years of age or older found that the prevalence of orthostatic hypotension increases with aging, and is associated with a faster deterioration in cognitive function.

Zimmermann, M., et al. Orthostatic Hypotension as a Risk Factor for Longitudinal Deterioration of Cognitive Function in the Elderly. **European J Neurol.** 2020; 27:160–167.

CANNABIS AND COGNITION IN MULTIPLE SCLEROSIS

Previous studies have suggested that patients with multiple sclerosis (MS) who smoke cannabis may experience greater cognitive compromise than those who do not. This study investigated the cognitive effects of cessation among chronic cannabis users with MS.

Subjects were 40 patients who began using cannabis after a diagnosis of MS. The participants were assigned to either a cannabis withdrawal (CW) group or a cannabis continuation (CC) group. All underwent evaluation using magnetic resonance imaging (MRI) and neuropsychological assessment at baseline and 28 days after the index assessment. Urine samples were used to verify the use and/or disuse of cannabis.

Baseline cognitive test results did not differ between groups. On day 28, compared to the CC group, the CW group had significantly better performance on every cognitive index ($p < 0.0001$ for all), including the Spatial Total Recall Test, the Controlled Oral Word Association Test, the Paced Auditory Serial Addition Test (2's and 3's) and the Selective Reminding Test-Long-Term Storage.

Conclusion: This study of patients with multiple sclerosis found that chronic users of marijuana who discontinued for 28 days demonstrated significant improvements in memory, processing speed and executive function.

Feinstein, A., et al. Coming off Cannabis: A Cognitive and Magnetic Resonance Imaging Study in Patients with Multiple Sclerosis. *Brain*. 2019, September; 142 (9): 2800-2812.

HIGH SENSITIVITY TROPONIN AND MYOCARDIAL INFARCTION

For patients presenting with chest pain, acute assessments often include electrocardiogram and serial measurements of cardiac troponin. With the development of high sensitivity troponin (hsTr) assays, rapid triage algorithms have been created. However, it is difficult to differentiate between those with acute myocardial infarction (MI) and those with other causes of chest pain or myocardial injury, using tests of hsTr. This study, the Calculation of Myocardial Infarction Risk Probabilities to Manage Patients with Suspicion of Myocardial Infarction (COMPASS-MI), was designed to

develop a tool to assess the probability of MI, using hsTr concentrations at emergency department presentation.

Data were combined for 15 prospective studies of patients presenting to an emergency department with suspected MI. Those with admission EKG findings demonstrating ST segment elevations were excluded. Concentrations of hsTr were measured as part of routine clinical care. Repeat samples were categorized as early (45 to 120 minutes) or late (120 to 210 minutes). The subjects were followed for at least one month to assess outcomes including death from any cause. Long-term outcomes of patients for whom MI was ruled out were compared to those of the general population.

A final diagnosis of MI was found in 3,455 of the 22,651 patients (15.3%). Those with hsTr concentrations of less than six ng/L and absolute change of less than four ng/L after 45 to 120 minutes resulted in a negative predictive value of 99.5% for MI and a 30-day risk of MI or death of 0.2%. In both the acute study population and the population-based cohort, hsTr concentrations were strongly associated with MI or death at one and two years.

Conclusion: This study of patients presenting to an emergency department with chest pain found that concentrations of, and changes in, high-sensitivity troponin can help estimate the probability of myocardial infarction and 30-day outcome.

Neumann, J., et al. Application of High-Sensitivity Troponin in Suspected Myocardial Infarction. *N Engl J Med*. 2019, June 27; 380(26): 2529-2540.

SUCCESSFULLY AGING FROM OLD TO VERY OLD

Successful aging has been defined as the maintenance of physical and cognitive well-being in later life, with no major disease or disability and high levels of engagement in life including productive activities and interpersonal relations. This study was designed to better understand successful aging past the age of ninety.

Data were included from participants in the 1921-1926 birth cohort of the Australian Longitudinal Study of Women's Health. At each survey, physical functioning scores were determined using the Medical Outcomes Study Form-36, and asked "Do you regularly need help with daily

tasks because of long term disease, disability or frailty?" Successful aging was determined using three indicators: No arthritis, heart problem, diabetes, asthma or cancer; physical functioning score of greater than 40; no need of regular help. The authors used these data to place participants in one of six categories of ageing.

Of the 12,432 participants at baseline, 67% had died by 2016. Six trajectory groups were identified including managed agers long survivors (9.0%) with disease but little disability, usual agers long survivors (14.9%) with disease and disability, usual agers (26.6%) and early mortality (25.7%). Successful agers were more likely to be married and to have good health behaviors, were better educated and had better social support. Those who died were more likely to have difficulty managing their income, to smoke or have smoked, to be overweight or to never participate in vigorous exercise.

Conclusion: This longitudinal study of Australian women found that only 5% of the very old were free of chronic disease, had no need of regular help and had good physical function scores.

Byles, J., et al. Successful Aging from Old to Very Old: Longitudinal Study of 12,432 Women from Australia. *Age Ageing*. 2019, November; 48(6):803-810.

VIRTUAL REHABILITATION AFTER TOTAL KNEE ARTHROPLASTY

Rates of total knee arthroplasty (TKA) have doubled in recent years. Given the projected paucity of physical therapists (PTs) in the near future, especially in rural areas, this study examined the cost and clinical outcomes of virtual PT after TKA.

Adult patients scheduled for TKA for non-traumatic degenerative joint disease were randomized to receive either virtual PT (VPT) or usual care. At baseline and during 12 weeks of follow up, follow up measures included a Knee Injury and Osteoarthritis Outcome Score (KOOS) for self-reported physical function, the Patient Reported Outcomes Measurement Information System (PROMIS) assessment of physical and mental health, and Satisfaction with Physical Function. Those in the VPT group used The Virtual Exercise Rehabilitation Assistant (VERA), a cloud-based virtual telehealth system that functions with use of three dimensional (3D) tracking technology to quantify pose and motion, an

(Continued from page 2)

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avatar (digitally simulated coach) to demonstrate and guide activity, visual and audible instructions and immediate feedback on exercise quality, and a virtual video connection for synchronous telehealth visits. Costs of care and outcomes were recorded for each group.

Data were complete for 306 patients. Those receiving virtual PT had a median total cost at 12 weeks \$1050 compared to \$2805 for the usual care group ($p < 0.001$). Functional measurement scores during follow-up were similar between groups. During 12 weeks of follow-up, rehospitalization occurred in 12 of the treatment group and 30 of the standard group ($p = 0.007$).

Conclusion: This study of patients hospitalized for total knee arthroplasty found that virtual physical therapy after discharge was as safe and effective as traditional physical therapy, with less than half the cost.

Bettger, J., et al. Effects of Virtual Exercise Rehabilitation In Home Therapy Compared with Traditional Care after Total Knee Arthroplasty: Veritas, A Randomized Controlled Trial. *J Bone Joint Surg.* 2020. <http://dx.doi.org/10.2106/JBJS.19.00695>.

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