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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 shown 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 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.

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.

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Busse, P., et al. Cytotoxicity of Drugs Injected into Joints in Orthopedics. **Bone Joint Res.** 2019, February; 8 (2): 41-48.

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.

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 Prefracture 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 Truvan 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 GLUTEUS TENDINOPATHY

Gluteal 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 gluteal tendinopathy.

The subjects were 80 patients 60 years of age or older, all with chronic gluteal tendinopathy. Each participant had radiologically confirmed grade II or III tendinopathy (no tear). The subjects were randomized to receive either LR-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 gluteal 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.

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.

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.

OBESITY PARADOX AND HIP FRACTURES

With the rise in obesity throughout the world many have expressed concern about the medical implications of this trend. However, several studies have reported that a high body mass index (BMI) is associated with improved survival among the elderly, especially those with certain chronic diseases. This study was designed to better understand the correlation between BMI and recovery after hip fracture.

Data were retrieved from a nationwide cohort study including patients 65 years of age and older treated for hip fracture during the years 2013- 2016. Of those in the database, 36% had a BMI recorded. The patients were divided into four groups based on their BMI. These included; less than 22 kg/m², 20-25 kg/m², 25-30 kg/m² and over 30 kg/m². Mortality was determined by BMI group.

Subjects were 17,756 surgically treated hip fractures, including 60% women. The one-year survival for both men and women was greatest among those with a BMI of greater than 30kg/m², second among those with a BMI of 25-30kg/m², third among those with a BMI of 22-25 kg/m² and worst in those with a BMI of < 22kg/m². This trend was similar for both men and women. Compared to the normal weight category, the odds ratio for men returning to home four months after fracture was 1.4 for those with a BMI of > 30 kg/m², 1.38 for those with a BMI of 25-30 kg/m², and 0.63 for those with a BMI of <22 kg/m². The same trend was noted for women.

Conclusion: This study of elderly patients with hip fracture found that the one-year survival was greater among those with a higher BMI.

Karin, M., et al. Obesity Holds True for Patients with Hip Fracture: A Registry-Based Cohort Study. *J Bone Joint Surg.* 2019, May 15; 101(10): 888-895.

RETURN TO WORK AFTER SHOULDER ARTHROPLASTY

With an aging population, an increasing number of shoulder surgeries are performed each year. Several studies have reviewed the return to work capacity of those undergoing such procedures. This systematic review and meta-analysis was completed to better understand this issue.

A data review was completed for studies of patients undergoing shoulder arthroplasty, which reported on return to work. Of those reviewed seven retrospective studies were chosen, representing data from 447 patients with a mean age of 63.6 years. Excluding those who were retired or not seeking employment before surgery, data from 317 patients were available for return to work analysis.

The overall return to work was 63.6% with a mean time out of work of 2.3 months. There was no difference in the rate of return to work between arthroplasty surgery type. Return to work was significantly lower for patients with physically intense occupations (p=0.04). No significant difference was noted between those undergoing surgery for osteoarthritis, rotator cuff arthropathy, humeral fractures or by workers compensation status.

Conclusion: This study of patients undergoing shoulder arthroplasty found that 64% returned to work at an average of 2.3 months after surgery.

Steinhaus, M., et al. Return to Work after Shoulder Arthroplasty: A Systematic Review and Meta-Analysis. *J Shoulder Elbow Surg.* 2019, May; 28(5): 998-1008.

SLEEP APNEA AND PERIOPERATIVE COMPLICATIONS WITH SHOULDER ARTHROPLASTY

Epidemiologic studies have shown the incidence of sleep apnea (SA) have increased 15-fold in the past 17 years. As sleep apnea has been shown to be an independent risk factor for infection and revision procedures after spine and total joint arthroplasty, this study was designed to determine whether sleep apnea increases the odds of complications, as well as readmission rates among patients undergoing shoulder arthroplasty.

Data for the study were derived from a patient record database including over 100 million patients from various insurance databases covering orthopedic patients. Records from the Medicare Standard Analytic files from 2005-

2014 were queried for patients with a diagnosis of SA undergoing primary total shoulder arthroplasty (TSA). Patients undergoing the same procedure without a diagnosis of SA served as controls. The 90-day medical, two- year implant related complications and 90-day readmissions as well as 90-day cost of care were compared between the two cohorts.

The SA group had a greater incidence of medical related complications compared with the control group (26% vs 12.3%; p<0.001). The two-year, short-term TSA-related complications were also greater in the SA group as compared to the control group (p<0.001). The 90-day readmission rate was similar between the two groups (p=0.828), though the 90-day costs were greater in the SA than in the control group (p<0.001).

Conclusion: This study of patients undergoing primary shoulder arthroplasty found that patients with a diagnosis of sleep apnea had a higher rate of medical complications and a higher cost of medical care.

Wang, C., et al. Perioperative Complications in Patients with Sleep Apnea Following Primary Total Shoulder Arthroplasty: An Analysis of 33,366 Patients. *J Orthop.* 2019, September-October; 16(5):382-385.

CATASTROPHIZING AND KNEE OSTEOARTHRITIS PAIN

Studies have demonstrated substantial variability in the pain of exercise for patients with chronic musculoskeletal pain, and that pain is one of the primary reasons for discontinuing exercise programs. As pain catastrophizing is an important predictive factor of pain, this study evaluated the effect of catastrophizing on the relationship between physical activity and daily knee pain in patients with knee osteoarthritis (KOA).

Subjects were 120 patients with advanced KOA, each awaiting unilateral total knee replacement. All were asked to complete self-report questionnaires, including demographics, psychosocial measures and pain related scales. Among the measures were the Pain Catastrophizing Scale (PCS), the WOMAC, the Godin-Shephard Leisure-Time Physical Activity Questionnaire (GSLTPAQ), the Patient-Reported Outcomes Measurement Information System (PROMIS), a visual analogue scale for pain, the Six-Minute Walk Test (6 MWT) and a record of physical activity.

Higher PCS scores were significantly related to increased pain ($p < 0.001$). The relationship between physical activity and pain was moderated by catastrophizing ($p < 0.001$). Catastrophizing was significantly and negatively related to results of the GSLTPAQ ($p < 0.05$) and the 6 MWT ($p < 0.05$).

Conclusion: This study of patients with knee osteoarthritis found that increases in pain on days of heightened physical activity are more pronounced among patients with relatively higher levels of catastrophizing.

Lazaridou, A., et al. The Association between Daily Physical Activity and Pain among Patients with Knee Osteoarthritis: The Moderating Role of Pain Catastrophizing. *Pain Med.* 2019, May; 20(5): 916-924.

COMPARISON OF FIVE TREATMENT OPTIONS FOR PATELLA TENDINOPATHY

Patella tendinopathy, sometimes referred to as jumper's knee, is a chronic overuse injury of the patella tendon. This study was designed to better understand the efficacy of common treatment options for this disorder.

The authors completed a secondary analysis of combined databases of three, randomized, controlled trials. The subjects were recruited through Dutch basketball, handball and volleyball associations. All studies were placebo controlled, with treatment options including eccentric training (ET), focused shockwave therapy (FSWT), radial shockwave therapy (RSWT), and topical glyceryl trinitrate (GTN). All subjects were assessed for pain function and sports participation with the Dutch VISA-P. Data were reviewed for 138 patients and compared by the treatment received. The primary outcome variable was clinical improvement, defined as an increase of 13 points or more on the VISA-P score after 12 to 14 weeks of treatment.

Of the 138 patients, 52 were "clinically improved" in VISA-P scores after three months of treatment. A multivariable logistic regression analysis demonstrated that both eccentric training alone ($p = 0.009$) and ESWT combined with eccentric training ($p = 0.015$) increase the chance for clinical improvement.

Conclusion: This combined analysis of three, placebo-controlled trials found that eccentric training alone or combined with extracorporeal shockwave therapy is effective for treating patella tendinopathy.

Van Rijn, D., et al. Comparison of the Effect of Five, Different Treatment Options for Managing Patellar Tendinopathy: A Secondary Analysis. *Clin J Sports Med.* 2019, May; 29 (3): 181-187.

DIETARY SUPPLEMENTS AND MORTALITY

Recent studies have suggested that more than half of US adults report the use of dietary supplements, despite a lack of clear evidence the benefits of many of these. This study evaluated the association between dietary supplement use and all cause mortality.

Data were obtained from the National Health and Nutrition Examination Survey (NHANES), including those who had provided information concerning diet. Those who reported supplement use were asked about product name, frequency, duration and serving form. Estimates were made of the total daily dose of each supplemental nutrient. From the dietary reports, inadequate and excess nutrition intake was calculated. The outcomes were obtained through a link to the National Death Index.

Among the participants, 51.2% reported using dietary supplements in the previous 30 days. The most commonly used vitamin supplements were vitamin C, vitamin E and vitamin D. The most commonly used mineral supplements were calcium, zinc and magnesium. More than half had inadequate dietary intake of vitamin D, vitamin E, choline, vitamin K and potassium. During a median follow-up of 6.1 years, 3,613 deaths occurred. A multivariable analysis found statistically insignificant associations for all supplements except for lycopene which was associated with lower risk of all cause death (relative risk 0.82) and cancer death (relative risk 0.66). Adequate intake of vitamin K and magnesium were associated with a lower risk of all cause death, though this reduction was associated with dietary and not supplement intake. Adequate intake of vitamin A, K, and zinc were associated with lower cardiovascular disease mortality, again restricted to dietary intake. Supplemental calcium intake of 1000 mg/d or higher was associated with an increased risk for cancer death.

Conclusion: This study found that supplement use was associated with a lower risk for all cause death, though these associations became insignificant after adjusting for education and lifestyle factors.

Chen, F., et al. Association Among Dietary Supplement Use, Nutrient Intake, and Mortality among US Adults: A Cohort Study. *Ann Intern Med.* 2019, May 7: 604–613.

BODY MASS INDEX AND MORTALITY

Over the past decades, the prevalence of obesity has increased worldwide. While many studies have suggested that obesity increases the risk of several adverse health conditions, others have noted a J-shaped relationship between body mass index (BMI) and mortality, with the most favorable point on the curve being overweight or normal weight. This study applied mendelian randomization techniques to better understand the causal relationship between BMI and all-cause mortality.

Data were obtained from the Norwegian Nord-Trøndelag Health (HUNT) study and the UK Biobank. Subjects included 65,229 adults followed from 1995–1997 until April 2015. Data included BMI, self-administered questionnaires, and a physical exam, including genotyping. The UK Biobank includes 366,385 adults of European ancestry. The authors selected 77 single nucleotide polymorphisms as candidate instrumental variables for BMI based on European sex-combined analyses in a genome-wide association study of the GIANT (Genetic Investigation of Anthropometric Traits) consortium. Several mendelian randomization analyses were completed, assessing the association between genetically predicted BMI and mortality outcomes or disease incidence.

An increase of one unit in genetically predicted BMI was associated with a 5% higher risk of mortality in overweight patients, and a 9% higher risk of mortality in obese patients. Conversely, an increase of one unit in genetically predicted BMI was associated with a 34% lower risk in underweight and a 14% lower risk in normal weight participants. In a subgroup analysis, a linear relationship between BMI and mortality was found in never smokers, with a J-shaped in ever smokers.

Conclusion: This study found that a J-shaped relationship between BMI and all-cause mortality was only evident among ever smokers with an always-increasing relation of BMI with mortality in never smokers.

Sun, Y., et al. Body Mass Index and All-Cause Mortality in Hunt and UK Biobank Studies: Linear and Non-

Linear Mendelian Randomization Analyses. *BMJ*. 2019; 364:1042.

DYSPORET FOR CERVICAL DYSTONIA

Cervical dystonia (CD) is a painful, and potentially disabling condition characterized by abnormal head and neck postures, functional impairment, and reduced quality of life. As botulinum toxin injections have been successful in managing CD, this study compared the effects of injections of premixed abotulinumtoxin A for injection (ASI), with injections of freeze dried, clinic mixed abotulinumtoxinA (FD), for changes in dystonia and quality of life.

Subjects were adult patients with a diagnosis of CD and with a Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS) total score of >30. Patients were randomized to receive

500 units of ASI, FD or a placebo. The patients were assessed for changes in spasticity, and for changes in the TWSTRS scores.

Of the 369 patients 156 received ASI, 159 received FD and 54 received placebo. Compared with placebo, quality of life, assessed by CDIP-58 total scores, was significantly improved at week four in both the ASI 500 U and the FD 500 U groups ($p < 0.0001$). A decrease in TWSTRS total score, was correlated with improvement in CDIP-58 total score. The effects of the two abotulinumtoxinA arms were similar.

Conclusion: This study of patients with cervical dystonia found similar positive effects with the use of a premixed abotulinumtoxinA to that of the traditional freeze dried- clinic mixed abotulinumtoxinA.

Simonetta, M., et al. Quality Of Life Improvements in Patients with Cervical Dystonia Following Treatment with a Liquid Formulation of Abotulinumtoxin A (Dysport). *Europ J Neurol*, 2019, June; 26 (6):943-947.

HIGH INTENSITY TRAINING AND HORMONE USE

Systemic inflammation is thought to adversely affect health. Among the factors that influence this inflammation are adiposity, physical activity and hormonal contraception. This study examined the influence of hormone contraceptive on changes in systemic inflammation after a 10 week course of strengthening and endurance training.

Subjects were women, 18-40 years of age, with a body mass index of less than 30 kg/m². Women were included who had at least one

year of hormonal contraceptive use (HUC), as well as those who had never used hormonal contraceptives (NHC). All were involved in four high intensity training sessions per week, consisting of two strength training sessions and two endurance training sessions. All subjects were assessed at baseline and after 10 weeks by performance measurements, and resting blood samples total cholesterol (Chol), low density lipoprotein (LDL), high density lipoprotein (HDL) and triglycerides, serum high sensitive C reactive protein (hs-CRP), Tumor-necrosis-factor- α (TNF- α), interleukin-6 (IL-6) and interleukin-1 β (IL-1 β). All measurements were made between one and five days of the menstrual cycle.

Compared to baseline, at 10 weeks, circulating concentrations of hs-CRP decreased significantly in the NHC group ($p = 0.009$), and increased significantly in the HCU group ($p = 0.048$). The between group difference was significant ($p = 0.015$). Circulating TNF- α , IL-1 β , and IL-6 concentrations were unaffected by exercise with no between-group differences observed.

Conclusion: This study found that systemic inflammation, as measured hs-CRP, decreased after 10 weeks of intensive training among women who never used hormonal contraceptives, and actually increased among those using hormonal contraceptives.

Ihalainen, J., et al. Changes in Inflammation Markers After a 10-Week High-Intensity Combined Strength and Endurance Training Block in Women: The Effect of Hormonal Contraceptive Use. *J Sci Med Sport*. 2019. <https://doi.org/10.1016/j.jsams.2019.04.002>.

MENTHOL'S EFFECT ON EXERCISE PERFORMANCE

Menthol is a naturally occurring organic compound that invokes a range of biological responses. Recent studies have explored the non-thermal cooling properties of menthol for relieving thermal strain associated with exercise in the heat. This literature review and meta-analysis was designed to better understand the effects of menthol application on exercise performance and thermal sensation.

A literature review was completed for controlled studies involving exercise performance, thermal sensation and menthol. From this review, 13 articles were chosen which examined the effect of menthol on exercise performance. In these studies, menthol was applied via five different mechanisms including oral mouthwash, spray,

cream/gel, drink, and immersion. In addition, 11 articles were included in a secondary analysis examining effects of menthol on thermal sensation during exercise. Overall, a small but significant improvement in exercise performance was found with menthol use compared to placebo ($p = 0.05$). Comparing the methods of application, internal application produced a greater effect than did the other applications ($p = 0.03$). In the secondary meta-analysis, a moderate to large reduction in thermal sensation during exercise was noted with menthol compared to control ($p < 0.001$). In this analysis, external application including spray, cream/gel and immersion resulted in moderate to large effects ($p < 0.001$), while internal applications produced small effects ($p < 0.004$).

Conclusion: This literature review and meta-analysis found that menthol has a positive effect on exercise performance, with internal applications more effective than external.

Jeffries, O., et al. The Effects of Menthol on Exercise Performance and Thermal Sensation: A Meta-Analysis. *J Sci Med Sport*. 2019, June; 22(6):707-715.

CRYOTHERAPY AND SLEEP QUALITY

Exercise training during the evening has been shown to disrupt sleep patterns. As studies have suggested that cryostimulation may have an impact on sleep-onset latency this study assessed the effect of whole-body cryotherapy (WBC) on sleep quality after evening training in physically active men.

Subjects included 22 physically active men, who regularly engaged in one hour of exercise at least three times per week. Beginning at seven o'clock in the evening subjects engaged in a standardized training session for 55 minutes, and then underwent either a three-minute WBC session or a three-minute passive recovery session. Each session consisted of a five-minute warm up, followed by a continuous exercise bout at 65% MAS for 25 min and an intermittent exercise bout consisting of three sets of seven minutes at 85% MAS separated by two minutes of active recovery at 60% MAS. Those randomized to the WBC group spent 30 seconds at -25°C in the first chamber and then three minutes in the main chamber at -40°C. Subjects were assessed for perceived fatigue and pain before and immediately after exercise, as well as the next morning using a visual analog scale. Each night

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participants wore a wrist actigraph to assess sleep quality. Subjective sleep quality was recorded using the Spiegel Sleep Quality Perception Questionnaire (SSQPQ).

The actigraph demonstrated that number of movements detected in the three spatial axes during sleep was significantly lower the night following WBC compared to the control condition ($p < 0.001$). The scores on the SSQPQ were significantly better in the WBC than the passive recovery group ($p < 0.05$). Compared to the evening fatigue and pain/muscle soreness, scores were significantly better in the WBC group than in the control group ($p < 0.01$).

Conclusion: This study found that a single session of whole-body cryotherapy after evening exercise can improve subjective and objective sleep quality and reduce perceived pain 24-hours after evening exercise in physically active men

Douzi, W., et al. Three-Minute Whole-Body Cryotherapy/Cryostimulation after Training in the Evening Improves Sleep Quality in Physically Active Men. *Eur J Sport Med.* 2019; 19(6): 860-867.

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