

# MUSCULOSKELETAL

IN REVIEW

TM

Volume 5, Number 4

Published by Physicians Specializing In  
Musculoskeletal Medicine

July 5, 2018

## VERTEBROPLASTY FOR VERTEBRAL FRACTURES

Percutaneous vertebroplasty is widely used to treat osteoporotic vertebral compression fractures. Prior research has produced conflicting data concerning the utility of vertebroplasty for reducing pain, disability, and improving quality of life. This study was designed to help clarify the efficacy of this procedure.

This randomized, double-blind trial included patients at least 50 years of age with one to three osteoporotic compression fractures. The subjects were randomized to receive polymethylmethacrylate cement injections or to undergo a sham procedure with periosteal needle placement, but no cement injection. The primary outcome measure was a ten-point visual analogue scale (VAS) for pain. Secondary outcome measures included the Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO) and the Roland-Morris Disability Questionnaire (RMDQ). Assessments were made at one day, one week, and one, three, six and 12 months after the procedure.

Both the vertebroplasty (n=90) and sham (n=86) groups showed a significant reduction in VAS scores at all times, with no significant difference between the groups at any follow-up. Statistically significant pain reduction began one day post-procedure in both groups. Similar patterns were found for QUALEFFO and RMDQ scores. A *post hoc* analysis did reveal more patients in the sham group with VAS scores of above five after 12 months.

**Conclusion:** This study of patients with painful osteoporotic vertebral fractures found no significant difference in pain reduction between groups treated with vertebroplasty and those treated with a sham procedure.

Firanescu C., et al. Vertebroplasty versus Sham Procedure for Painful, Acute, Osteoporotic, Vertebral, Compression Fractures (VERTOS IV): Randomized, Sham Controlled,

Clinical Trial. *BMJ*. 2018; 361:k1551.

## PULSED RADIOFREQUENCY VERSUS CORTICOSTEROID INJECTION FOR NECK PAIN

The prevalence of head and upper cervical pain in the general population ranges from 30-50%. Recent studies have suggested that the atlanto-occipital (AO) joint plays a major role in the occurrence of head pain and/or upper cervical pain. As pulsed radiofrequency (PRF) has been used for chronic musculoskeletal pain, this study compared the effectiveness of this technique with that of intra-articular steroid injections.

Subjects were 23 patients with spontaneous, chronic, suboccipital neck pain who were refractory to physical therapy and medication. Dysfunction of C2-3 in the lower cervical facet was excluded through a third occipital nerve block and a medial branch block with a negative response. Those randomized to an RF group received stimulation with a PRF needle in the AO joint, at 5 Hz and 5 ms pulse width for six minutes at 55 V. Those in the corticosteroid group received an intraarticular joint at the AO, of 0.75 mL of 2% lidocaine and 0.25 mL of triamcinolone 10 mg. Pain was assessed before treatment and at one, three and six months after the procedure using a 10-point Numeric Rating Scale (NRS). Success was defined as greater than a 50% reduction in pain.

Compared with baseline, the mean NRS scores were significantly reduced in both groups ( $p < 0.001$ ). Greater than 50% improvement was achieved in 66.7% of the PRF group and in 63.6% of the corticosteroid group ( $p = 0.879$ ).

**Conclusion:** This study of patients with chronic suboccipital pain found that radiofrequency may be considered a reasonable treatment option to intra-articular steroids at the atlanto-occipital joint.

Shin, S., et al. Clinical Effectiveness of Intra-Articular, Pulsed

Radiofrequency Compared to Intra-Articular Corticosteroid Injection for Management of Atlanto-Occipital Joint Pain. A Prospective, Randomized, Controlled Pilot Study. *Spine*. 2018, June 1; 43(11): 741-746.

## REMOTE KINEMATIC TRAINING FOR CHRONIC NECK PAIN

Patients with neck pain often have reduced movement efficacy, with impairments in driving and symptoms such as dizziness or kinesiophobia. This study evaluated the efficacy of two methods of home delivery for chronic neck pain, including virtual reality and laser pointer feedback.

Patients with chronic neck pain were randomized to either a control group or one of two treatment groups. The treatment groups included kinematic training, with the use of virtual reality (KTVR) or a laser pointer (attached to forehead). All subjects underwent four weeks of training. In both intervention groups, the training was provided to increase the range of motion, velocity of motion and the accuracy of head motion. The primary outcome measure was the change in the neck disability index, global perceived effect and cervical motion velocity.

Of the patients recruited, 76 completed a one month, and 56 completed a three-month follow-up. The control group demonstrated no change in any variable. Compared with the control group, the neck disability index was significantly improved with virtual reality ( $p < 0.01$ ), as well as with laser training ( $p < 0.01$ ). At three-month follow-up, neck pain was rated as much improved in 45.2% of the virtual reality group, and in 42.1% of the laser group.

**Conclusion:** This study of patients with chronic neck pain found that a minimally supervised home treatment using a laser pointer or virtual reality could significantly decrease disability and pain.

## **Editor-in-Chief**

Daniel Burke, B.S.  
Georgia College & State University,  
Milledgeville, GA

## **Content Editor**

David T. Burke, M.D., M.A.  
Emory University, Atlanta, GA

## **Executive Editor**

Di Cui, M.D.  
Emory University, Atlanta, GA

## **Copy Editor**

Tracie E. McCargo, EMBA  
Harvard University Extension School,  
Cambridge, MA

## **Distribution Manager**

Michael P. Burke, M.S.

Bahat, H., et al. Remote Kinematic Training for Patients with Chronic Neck Pain: A Randomized, Controlled Trial. *Eur Spine J.* 2018, June; 27: 1309-1323.

### **HETEROTOPIC OSSIFICATION FOLLOWING ELBOW ARTHROPLASTY**

Heterotopic ossification (HO) is a recognized sequela of both elbow trauma and total elbow arthroplasty (TEA). However, the true incidence of HO at the elbow is not well understood. This study was designed to better understand the incidence of HO following elective TEA and arthroplasty surgery for humeral fractures.

This retrospective study included all primary TEAs performed between 2007 and 2015, comparing those undergoing elective procedures and those with trauma related TEAs. All patients were assessed using elbow specific outcome scores and follow-up x-rays at a mean of 3.1 years.

At three years, among the 53 patients, the overall incidence of HO was 84%. The incidence was higher in the trauma group (96%) than the elective arthroplasty group (72%). There were no patients with Booker class IV (ankyloses), while 15/25 of the trauma group, and 3/21 of the elective group were Booker class II–III. At follow-up, the mean flexion/extension arcs were 97° in the elective group and 93° in the trauma group.

**Conclusion:** This study of patients undergoing total elbow arthroplasty revealed that the incidence of heterotopic ossification at

three-year follow-up was 84%, with higher rates in the trauma than the elective surgery group.

Robinson, P., et al. Heterotopic Ossification following Total Elbow Arthroplasty. *Bone Joint J.* 2018, June; 100-B (761-771).

### **POST-CONCUSSIVE LIGHTHEADEDNESS, VERTIGO, AND SYMPTOM DURATION**

Dizziness is a frequent complaint after concussion but is nonspecific and is often reported as either lightheadedness or vertigo. This study was designed to determine the prevalence of post-concussive lightheadedness, and to determine its relationship to overall symptom duration.

This prospective, cohort study included patients, ages nine to 19 years, with a history of concussion during the prior 30 days. Subjects completed two symptom questionnaires, one at the time of the concussion and then another on the day of evaluation. Subjects rated the severity of 23 post-concussion symptoms, including lightheadedness and vertigo.

The 510 subjects had a mean age of 13.9 years and a mean interval from concussion to evaluation of 9.7 days. From the day of injury, more subjects recalled a sensation of lightheadedness (70.8%) than of vertigo (48.6%) ( $p < 0.001$ ). At clinic evaluation, more subjects also reported lightheadedness (47.1%) than vertigo (24.1%) ( $p < 0.001$ ). Mean symptom ratings for both lightheadedness and vertigo improved from injury to evaluation. Post-concussive symptom duration was influenced by reports of dizziness/fogginess, including lightheadedness ( $p = 0.028$ ). The duration of post-concussive symptoms was greater among females ( $p = 0.04$ ) and among those with emotional symptoms recalled from the date of concussion ( $p = 0.028$ ), dizziness/fogginess, symptoms which include lightheadedness ( $p = 0.007$ ) and cephalalgic symptoms reported on the day of the evaluation ( $p < 0.001$ ).

**Conclusion:** Lightheadedness is more frequently reported than vertigo after concussion. Lightheadedness, along with vertigo and balance difficulties, are associated with a longer duration of overall post-concussive symptoms.

Heyer, G., et al. Lightheadedness after Concussion: Not All Dizziness is Vertigo. *Clin J Sport Med.* 2018, May; 28(3): 272-277.

### **GLUCOCORTICOIDS AND RISK OF VERTEBRAL FRACTURE IN RHEUMATOID ARTHRITIS**

Previous studies have shown that patients with rheumatoid arthritis (RA) experience fractures more frequently than do those in the general population. Among the risk factors for fractures is the use of glucocorticoids, widely used in the treatment of RA. This study was designed to identify specific effects of glucocorticoid treatment on fracture types.

This study used a nationwide claims database in Korea, the Health Insurance Review Assessment Service, which covers 98% of the Korean population. From this database, patients with RA were identified, as were the prescriptions of disease modifying antirheumatic drugs (DMARDs) glucocorticoids and a diagnosis of osteoporosis. Risk of fractures was compared to that of the general population.

Of the 138,240 patients with RA, fractures were identified in 9,964. A crude analysis revealed that the duration of glucocorticoid steroid use was associated with total fracture risk, with odds ratios of 1.22 for those treated from three to six months, and

1.81 for those treated for more than six months. An adjusted analysis revealed an increased risk for those treated for more than six months, of any fracture ( $p < 0.05$ ) and of vertebral fractures ( $p < 0.05$ ). Those taking a mean dose of five to 10 mg were at increased risk for total fracture ( $p < 0.05$ ) and vertebral fracture ( $p < 0.05$ ), as compared to those taking less.

**Conclusion:** This Korean study of patients with rheumatoid arthritis found that, for those treated with oral glucocorticoids, a higher dose and longer treatment duration were significantly related to an increased risk of hip or spine fracture.

Kim, D., et al. Glucocorticoids are Associated with an Increased Risk for Vertebral Fracture in Patients with Rheumatoid Arthritis. *J Rheum.* 2018, May; 45 (5): 612-620.

### **COMPLICATIONS OF ANTICOAGULATION AFTER SPINE TRAUMA**

Previous studies of spine surgery have examined the complications of prophylactic anticoagulation, but not therapeutic anticoagulation. This study was designed to better understand the incidence of complications among patients

requiring an unplanned return to surgery with therapeutic anticoagulation.

This retrospective study included patients who underwent surgery for traumatic spinal column injury between 2001 and 2014 and who sustained a thromboembolic event (DVT, PE or MI). Patients who were then placed on anticoagulation were compared to matched patients who were not. The primary outcome variable was the rate of complications that required unplanned reoperation.

Of the 1,712 patients, 62 were diagnosed with a thromboembolic event after surgery. Of these, 18% receiving therapeutic anticoagulation required an unplanned return to the operating room, compared to 10% of those not receiving therapeutic anticoagulation ( $p = 0.17$ ). A subgroup analysis showed a reoperation rate of 31% of patients receiving heparin infusion, compared to 6.5% in patients receiving low molecular weight heparin ( $p = 0.02$ ).

**Conclusion:** In this study of patients with traumatic spinal injury with a post-surgical thromboembolic event, those placed on an anticoagulant had a higher rate of return to surgery than did those not receiving an anticoagulant, especially among those receiving IV heparin.

Shiu, B., et al. Postoperative Deep Vein Thrombosis, Pulmonary Embolism and Myocardial Infarction: Complications after Therapeutic Anticoagulation in the Patient with Spine Trauma. *Spine*. 2018, July 1; 43(13): E766-E772.

### CLOSTRIDIUM DIFFICILE AFTER SPINE SURGERY

*Clostridium difficile* (C Diff) infection is a common complication of inpatient hospitalization, and a significant cause of morbidity and mortality. This study was designed to determine the incidence, timing and risk factors of developing C Diff in spine surgery patients.

This retrospective, cohort study, utilized the 2015 National Surgical Quality Improvement Program (NSQIP) database. Subjects were 23,981 patients who underwent spine surgery in 2015. Patients undergoing emergency surgeries or those with diagnosis codes indicating trauma, tumor or infection were excluded. The researchers determined the rate of C Diff colitis within a 30-day post-operative period.

The incidence of C Diff colitis in the 30-day post-operative period was 0.11%. Of these, 70% were diagnosed post-discharge and 80% had no

previous diagnosis of C Diff. The development of C Diff was associated with combined anterior/posterior fusion procedures (OR 12.29,  $p=0.01$ ), increased age (OR

10.31  $p<0.001$  for patients 76 and older), hypoalbuminemia (OR 6.40,  $p = 0.023$ ) and anemia (OR 2.39,  $p < 0.001$ ).

**Conclusion:** This study found that C Diff is diagnosed within 30 days in 0.11% of patients undergoing spine surgery. Most of these cases occurred after discharge.

Bovonratwet P., et al. Incidence, Risk Factors and Impact of Clostridium Difficile Colitis after Spine Surgery. *Spine*. 2018, June 15. 43:861-868.

### POTENTIATING PAIRED CORTICOSPINAL-MOTONEURONAL PLASTICITY AFTER SPINAL CORD INJURY

It is known that pairing noninvasive stimulation of the primary motor cortex and a peripheral nerve, known as paired corticospinal transmission-motoneuronal stimulation (PCMS), enhances corticospinal transmission in patients with chronic spinal cord injury (SCI). This study examined whether voluntary activity can also increase the excitability of spinal motoneurons, subsequently potentiating PCMS effects on corticospinal transmission in chronic SCI patients.

Subjects were 17 patients with SCI, and 14 age-matched controls. Corticospinal volleys evoked by TMS over the hand representation of the primary motor cortex were timed with peripheral electrical stimulation of the ulnar nerve. The PCMS was applied at rest (PCMS<sub>active</sub>), and during a small level of isometric index finger abduction (PCMS<sub>active</sub>). Motor evoked potentials (MEPs) elicited by TMS and electrical stimulation were measured in the first dorsal interosseous muscle in both case and control groups.

In patients with SCI, MEPs elicited by the combined TMS and peripheral electrical stimulation were increased when compared to controls. Those SCI patients who did not respond to PCMS<sub>rest</sub> did respond with PCMS. Those who responded to both, demonstrated larger increments with active PCMS.

**Conclusion:** Muscle contraction during paired corticospinal transmission-motor neuronal stimulation potentiates corticospinal transmission, suggesting a technique that may be used to increase spinal plasticity after spinal cord injury.

Bunday, K., et al. Potentiating Paired

Corticospinal-Motoneuronal Plasticity after Spinal Cord Injury. *Brain Stim*. Article in Press. 2018: <https://doi.org/10.1016/j.brs.2018.05.006>.

### PREDICTING FUNCTIONAL OUTCOME IN LOWER LIMB AMPUTEES

It is well known that lower limb amputations have a substantial impact on a patient's physical capabilities and quality of life. This study was designed to develop a preoperative scoring tool to predict the probability of ambulation among patients receiving a lower limb amputation.

The authors identified variables suggested in the literature as being important to the functional outcomes of patients with amputations. Eight, preoperative variables were identified as potentially affecting the success of rehabilitation. These included, younger age (progressively scored as less likely to walk in age categories of 50 to 64, 65 to 74, 75 to 80 and over 80), male gender, lower body mass index (with scores worsening at 25 to 30 kg/m<sup>2</sup>, 18.5 kg/m<sup>2</sup> or less and 40 kg/m<sup>2</sup> or greater), more distal amputation, trauma patients (with worse scores for amputations related to cancer, orthopedic and vascular), fewer medical comorbidities, (myocardial infarct, stroke, renal failure and severe respiratory disease), higher mobility pre-amputation and lack of cognitive impairment. A scoring system was created to reflect these variables.

Using the scoring system proposed in this tool, named the BLART tool, those with a score of 13 or above did not achieve a good functional outcome, and those with a score of 17 or more did not achieve any walking function.

**Conclusion:** This tool suggests that the BLART tool may be effective in providing an estimate of prognosis for pre-surgical lower limb amputation.

Bowrey, S., et al. Development of a Scoring Tool (BLART Score) to Predict Functional Outcome in Lower Limb Amputees. *Disabil Rehab*. 2018 DOI:10.1080/09638288.2018.1466201

### EFFECT OF EXERCISE ON PAIN SENSITIVITY

Aerobic or weight lifting exercise has been noted to reduce pain sensitivity, an effect termed exercise induced hypoalgesia. This study evaluated whether short bouts of maximal anaerobic exercise would result in analgesic effects on induced pain and

whether noxious stimulus at one location could lead to reduced perceptions of pain in another location.

Fifty health individuals were randomized to either a control group or the Wingate Anaerobic test (WAT) group. The WAT involved 30 seconds of maximum effort pedaling on stationary bikes. Immediately after performing the WAT, participants were asked to verbally rate their leg muscle pain using the 0–100 NPS, and then tested for heat, cold and pressure induced pain. The effect of stimuli at two sites on perceived pain was measured by applying noxious stimuli at a remote body part while perceived pain to a separate noxious stimulus was measured. The aerobic group was compared to the control group.

Compared to the controls those in the WAT had decreased ratings of their perceived pain to heat and cold stimuli ( $p < 0.001$ ), had higher pain pressure thresholds ( $p < 0.001$ ), and had decreased pain at measured sites when distal noxious stimuli were applied ( $p = 0.029$ ).

**Conclusion:** This study suggests that engagement in 30 seconds of maximal anaerobic effort will lead to acute analgesic effects.

Samuelly-Leichtag, G., et al. A Fast Track to Hypoalgesia – The Anaerobic Exercise Effect on Pain Sensitivity. *Int J Sports Med.* 2018; 39:473-481.

### **SURGERY AND PT FOR FEMORAL ACETABULAR IMPINGEMENT TREATMENT**

Arthroscopic hip surgery is often considered the standard treatment for patients with femoral acetabular impingement syndrome (FAIS). This study compared surgery to physical therapy (PT) for the treatment of FAIS.

At a single military hospital, 80 patients with FAIS were randomized to undergo surgery (acetabuloplasty, labral repair/debridement or femoroplasty, per the surgeon's clinical judgement) or a supervised physical therapy (PT) program, performed twice weekly for a total of 12 sessions. At baseline, all participants were evaluated using the Hip Outcome Score (HOS) ADL and Sport subscales and the International Hip Outcome Tool (iHOT-33), with these repeated at six, 12 and 24 months. The primary outcome measure was the HOS, administered at two years.

No significant difference was

found between the groups at any time point of the study on the HOS - ADL subscale, the HOS-Sport subscale or the iHOT-33 scale. Further, no significant differences were found between the groups in perceived current level of function, with 58.1% of the entire cohort failing to perceive a clinically meaningful change at two years, and with no significant difference between groups. Despite this, 28 patients in the PT group had chosen to undergo surgery within the two years.

**Conclusion:** This study of patients with femoral acetabular impingement found no statistically significant difference in outcomes between surgical and non-surgical treatment of FAIS.

Mansell, N., et al. Arthroscopic Surgery or Physical Therapy for Patients with Femoroacetabular Impingement Syndrome. *Am J Sports Med.* 2018, May; 46(6): 1306-1314.

### **SYSTEMIC EFFECTS OF EPIDURAL STEROID INJECTIONS FOR SPINAL STENOSIS**

Epidural steroid injections (ESIs) are used frequently for a variety of back conditions and are considered to be safe procedures. However, several case reports have shown that even a single dose of ESI can cause adrenal suppression. This study was designed to determine whether a single epidural injection with corticosteroids plus lidocaine causes greater cortisol suppression than does an epidural injection with lidocaine alone.

Subjects were 400 patients with low back pain who were scheduled for an ESI. The participants were randomized to receive an epidural with corticosteroid plus lidocaine (CL) or lidocaine alone (L). A morning fasting serum cortisol level was measured at baseline and again three weeks after the epidural.

Overall, patients in the CL group averaged a 14.4% reduction in cortisol at week three as compared to baseline, while the L group had an average increase of 8.2%. Of the four different corticosteroids used, those injected with methylprednisolone or triamcinolone had reductions in cortisol at three weeks of 41% and 41.6%, respectively ( $p = 0.005$  and  $p < 0.001$ , respectively). Those treated with betamethasone or dexamethasone had an average

cortisol reduction of 1.8% and 23.3%, respectively.

**Conclusion:** This study confirms that a single epidural steroid injection can suppress cortisol levels for up to three weeks after the injection.

Friedly, J., et al. Systemic Effects of Epidural Steroid Injections for Spinal Stenosis. *Pain.* 2018, May; 159: 876 -883.

### **VERY LOW CARBOHYDRATE DIET AND HIGH INTENSITY INTERVAL TRAINING**

As carbohydrate availability and muscle glycogen content are primary components of metabolism and exercise performance, restriction of endogenous carbohydrate availability would seem to adversely affect strenuous exercise performance. This study examined the effects of a very low carbohydrate high fat (VLCHF) diet on cardiorespiratory and metabolic responses during high intensity interval training (HIIT).

Eighteen, moderately trained males were recruited. The subjects were randomized to either remain on a western based mixed diet or to begin a VLCHF diet (eight percent carbohydrates, 29% protein and 63% fat) for four weeks. HIIT sessions occurred three times per week for four weeks and involved a 10-minute warm-up at 60%  $VO_{2max}$ , followed by five, high-intensity repetitions, consisting of three minutes at 100%  $VO_{2max}$ , separated by 1.5 minutes of passive recovery (work to rest ratio, 2:1), for a total of 34 min. A maximal incremental treadmill test was performed at baseline and after two and four weeks of training. Heart rate, oxygen uptake, respiratory exchange ratio, total time to exhaustion and maximal  $VO_{2max}$  were measured.

Changes in body mass averaged 4.7 kg in the VLCHF group and 0.8 in the control group, while body fat percentages were reduced by 3.2% and 1.1%, respectively. The  $VO_{2max}$  increases were 3.1ml/kg/min in the VLCHF group and 1.5ml/kg/min in the control group.

**Conclusion:** This study found no adverse effects on any aspect of performance in subjects consuming a high-fat diet for four weeks.

Cipryan, I., et al. Effects of a Four-Week, Very Low Carbohydrate Diet on High Intensity Interval Training Responses. *J Sports Sci Med.* 2018; 17:259-268.

### **CARDIORESPIRATORY FITNESS THROUGH E-BIKE AND CONVENTIONAL BICYCLE COMMUTING**

Electrically assisted bicycles (e-bikes) have becoming increasingly popular in the past decade, particularly along the elderly who would normally have difficulties with regular bicycles. This study investigated the cardiovascular benefits of e-bikes.

Subjects were recruited from governmental offices who were 18 to 50 years of age, with a body mass index of 25 to 35 kg/m<sup>2</sup>, and who conveyed a willingness to commute to work by bicycle. The participants were randomized to either a conventional bicycle group or an e-bike group, and were asked to commute to work at a self-chosen speed at least three days per week for four weeks. All subjects were assessed at baseline for height, body mass, blood pressure, electrocardiogram results and VO<sub>2</sub> peak. The primary outcome variable was the change in VO<sub>2max</sub>. Secondary measures included resting heart rate, systolic and diastolic blood pressure and body mass index (BMI).

The VO<sub>2max</sub> improved by a mean of 3.6 mL/kg-min in the e-bike group, and 2.2 mL/kg-min in the conventional bike group (p=0.327). Improvements were seen in both groups in systolic blood pressure, diastolic blood pressure and body mass index, with no significant difference between the two groups.

**Conclusion:** This study demonstrates that the use of electric assisted bicycles for daily commuting to work can produce cardiovascular gains similar to those achieved by commuting with a conventional bicycle.

Höchsmann, C., et al. Effect of E-Bike versus Bike Commuting on Cardiorespiratory Fitness in Overweight Adults: A Four-Week, Randomized Pilot Study. *Clin J Sport Med.* 2018; 28(3): 255-261.

### **ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION OVER AGE FIFTY**

Anterior cruciate ligament (ACL) reconstruction is one of the most common orthopedic surgeries. Given an aging population, this study was designed to compare the outcomes of ACL reconstruction in patients over 50 with those of

younger patients.

This prospective study compared the outcomes of 28 consecutive patients, 50 years of age or older, with 36 patients under 40 years of age, all presenting for reconstruction of an ACL tear. Data collected at baseline and at five years' follow-up included subjective functional status, assessed using the Lysholm score, activity level, assessed with the Tegner Activity Scale, development of osteoarthritis (OA), assessed by radiological evaluation and joint laxity measurement using the KT-1000 arthrometer.

The mean time to return to activity was 102 days in the older subjects and 93 days in the younger group (p>0.05). At the final evaluation, no difference was found between the younger and older groups in Lysholm scores (p=0.20), Tegner Activity Scale scores (p=0.22) or the development of degenerative OA. The mean side-to-side differences in the KT-1000 arthrometric evaluation of laxity were 1.6mm in the older group and 2.7mm in younger group (p=0.009).

**Conclusion:** This study of patients undergoing anterior cruciate ligament reconstruction repair found that those over age 50 can achieve comparable results to younger patients.

lorio, R., et al. Anterior Cruciate Ligament Reconstruction in Patients Older than Fifty Years: A Comparison with a Younger Age Group. *Intern Ortho.* 2018, May, 42 (5): 1043-1049.

### **ANTICHOLINERGIC MEDICATIONS AND THE LONG-TERM RISK OF FALLS**

Drugs with anticholinergic properties include antispasmodics, antiparkinsonian drugs, antidepressants and antipsychotics, among others. This study was designed to better understand the association between the use of anticholinergic drugs among the elderly and the risk of falls with hip fracture.

This case control study identified individuals 60 years of age or older with a hip fracture diagnosis during the year 2015. These individuals were matched with two controls who had not sustained a hip fracture. Data collection included socio-demographics, diagnoses and drugs prescribed within the previous month. These medications were categorized by pharmacological

groups, with the total anticholinergic load of each medication calculated using the Anticholinergic Risk Scale (ARS). The association between this load and the risk of a fall with a hip fracture was determined.

Subjects were 300 patients with hip fracture and 600 controls, with a mean age of 81.6 years. A multivariate analysis revealed that the relative risk of falls with hip fractures increased among those receiving proton pump inhibitors (p=0.017), systemic corticosteroids (p<0.046) or conventional antipsychotic medications (p=0.029). Those with ARS scores of two and three had a significantly increased risk of fracture, with each additional point increasing the risk of fracture by 11.6%. In addition, two cities were identified as locations associated with a greater risk of fracture.

**Conclusion:** This study of patients 60 years of age or older found that anticholinergic medications, with combined anticholinergic loads of two or more, are associated with an increased risk of falls with hip fracture.

Machado-Duque, M., et al. Drugs with Anticholinergic Potential and Risk of Falls with Hip Fracture in the Elderly Patients: A Case-Controlled Study. *J Geriatr Psychiatry Neurol.* 2018, March; 31 (2): 63-69.

### **BIOLOGIC DISEASE-MODIFYING ANTI-RHEUMATIC DRUGS AND THE INCIDENCE OF HIP AND KNEE REPLACEMENT**

Tumor necrosis factor-alpha inhibitors (TNFi) have been the mainstay of biologic disease modifying anti-rheumatic drugs since their introduction in the late 90s. This study investigated whether treatment with biologic disease-modifying anti-rheumatic drugs (DMARDs) may have altered the incidence of hip or knee replacements.

This Danish study used the Danish National Patient Register to identify patients with rheumatoid arthritis (RA) treated between 1996 and 2011. For each of the patients with RA, the authors matched up to

10 persons from the general population. From the records, prescriptions of DMARDs were identified. In addition, the five-year age and gender standardized incidence rates for total hip arthroplasty (THA) and total knee arthroplasty (TKA) were evaluated

and compared between groups.

Subjects were 30,404 patients with incident RA and 297,916 controls. In 1996, the five-year incidence of THA was 8.72 per 1,000 patient years among patients with RA, and 2.89 per 1,000 patient years for controls. For TKA, the five-year incidence was 5.87 per 1,000 patient years for patients with RA and 0.42 per 1,000 patient years for controls. Before the introduction of DMARDs, there was an increasing trend in the incidence of THR among patients with RA. After the introduction of DMARDs, the rates of THA and TKA decreased among patients with RA ( $p=0.004$  and  $p=0.083$  respectively), while increasing among the general population ( $p=0.04$  and  $p=0.003$  respectively). **Conclusion:** This Danish study of patients with rheumatoid arthritis found a significantly higher rate of hip and knee replacement compared to the general population, with that rate decreasing after introduction of disease-modifying anti-rheumatic drugs.

Cordtz, R., et al. Incidence of Hip and Knee Replacement in Patients with Rheumatoid Arthritis following the Introduction of Biologic DMARDs: Uninterrupted Time-Series Analysis Using Nationwide Danish Healthcare Registers. *Ann Rheum Dis.* 2018, May; 77(5): 684-689.

#### **BOTULINUM TOXIN FOR TENNIS ELBOW**

Lateral epicondylar tendinopathy is thought to be induced by repetitive motion of the wrist and digit extensors. This study assesses the analgesic effects of low-dose Botulinum toxin A (BoNT-A) injections for the treatment of chronic lateral epicondylar tendinopathy.

Subjects were 60 adults with lateral epicondylar tendinopathy, resistant to medical treatments for more than six months. The subjects were randomized to receive 40 international units of BoNT-A injected at the extensor carpi radialis brevis, or normal saline, with confirmation using electromyographic stimulation. Pain was measured at 30, 60 and 90 days using a 100 point visual analog scale.

At 30 and 90 days follow-up a > 50% reduction in pain intensity was reported by more in the treatment group (31% and 51% respectively) than in the placebo group (16.7% and 25% respectively), reaching

significance only at 90 days ( $p=0.11$ , and  $p=0.005$  respectively). Those reporting no symptoms or only occasional pain at 90 days included 51.7% of the treatment and 21.4% of the placebo group ( $p<0.01$ ). Clinically assessed paresis persisted in 17% of the treatment and 0% of the placebo group at 90 days.

**Conclusion:** This randomized controlled study of patients with chronic lateral epicondylar tendinopathy found that an injection with 30 units of Botulinum toxin A could significantly reduce pain intensity.

Creuzé, A., et al. Short-Term Effect Of Low Dose, Electromyography Guided Botulinum Guided Injection In The Treatment Of Chronic Lateral Epicondylar Tendinopathy. *J Bone Joint Surg.* 2018, May 16; 100(10):818-826.

#### **EXPOSURE TO ROADWAY POLLUTION AND LUNG FUNCTION**

Previous studies have demonstrated that short-term exposure to ambient pollution is acutely harmful to adult lung function. This study examined the effect on lung function of proximity to a major roadway and annual exposure to particulate matter (<2.5  $\mu\text{m}$  in diameter (PM<sub>2.5</sub>)).

Subjects were 2,545 patients from the Framingham Offspring and Third Generation Cohort who had undergone inspiratory lung computerized tomography (CT) scans, and who were not currently smoking. All underwent CT scan for evaluation of pulmonary structural parameters and the presence of emphysema. The distance from a patient's home to a major roadway was calculated, and the density of fine particle matter at the home address was estimated. The data were adjusted for age, gender, height, weight, median value of the home, population density, education level, smoking history and date of CT scan.

Subjects had a mean age of 60.1 years, with 11% demonstrating CT evidence of emphysema. Proximity to a major roadway was associated with significantly higher inspiratory lung volume but no significant relationships were found between proximity and lung mass, lung density, odds of emphysema or airway lumen. Former smokers had a significantly increased odds of emphysema ( $p=0.05$ ).

**Conclusion:** This study, from

the Framingham cohort, found that people living closer to a major road, while having higher average inspiratory lung volumes, had no evidence of an association between ambient pollution and radiographic measures of emphysema or airway disease.

Rice, M., et al. Exposure to Traffic Emissions and Fine Particulate Matter and Computer Tomography Measures of the Lung and Airways. *Epidem.* 2018; 29: 333-342.

#### **INTRA-ARTICULAR AND INTRAOSSEOUS PLATELET RICH PLASMA INJECTIONS FOR KNEE OSTEOARTHRITIS**

For patients with osteoarthritis (OA) of the knee, intra-articular injections of hyaluronic acid (HA) and platelet rich plasma (PRP) have been used as nonsurgical treatments. A new technique of PRP injection has been introduced, combining intraosseous (IO) infiltration with intra-

-articular (IA) injection. This study compares the efficacy of IO injections of PRP combined with IA injections of either HA or PRP.

Subjects were 99 patients with unilateral OA of the knee, ages 40 to 73 years, with an average body mass index (BMI) of 18-32.5  $\text{kg}/\text{m}^2$ . The patients were randomized to receive injections of PRP 2 mL placed IA and IO at the tibial plateau and medial femoral condyle every two weeks (group A), PRP 6 mL IA (group B) or seven weekly IA injections of HA 2 mL (group C). The primary outcome variable was the Western Ontario and McMaster Universities (WOMAC) score, with patients evaluated before treatment and at one, three, six, 12 and 18 months from the last injection. Improvement on the visual analog scale (VAS) for pain was noted in all groups from pretreatment to one and three months follow-up, with significantly greater pain reduction in group A, as compared to groups B and C. The WOMAC total scores indicated significant improvement in group A at every follow-up time point, while those of groups B and C were not significantly improved at the 18<sup>th</sup> month.

**Conclusion:** This study of patients with osteoarthritis of the knee found that combining intra-articular and intraosseous injections of platelet rich plasma may be more effective in relieving pain and improving daily activities than are

intra-articular injections of PRP or HA.

Su, K., et al. Comparison of Hyaluronic Acid and PRP Intra-Articular Injection with Combined Intra-Articular and Intraosseous PRP Injections to Treat Patients with Knee Osteoarthritis. *Clin Rheumatol* 2018, May; 37 (5): 1341-1350.

### LAVENDER OIL FOR KNEE OSTEOARTHRITIS

It is estimated that approximately 27 million Americans have osteoarthritis (OA), with this prevalence expected to increase to 70 million in upcoming decades. As pharmacologic treatments are often less than fully effective, and have various side-effects, some have looked to complementary therapies as an alternative. As previous research has suggested that lavender oil may be helpful for patients with neck pain, this study reviewed its effects on patients with OA of the knee.

Subjects were adult patients referred to outpatient rheumatology clinics with a diagnosis of OA of the knee, with pain levels of four or greater on a 10-point visual analog scale. The participants were randomized to receive aroma massage, placebo massage or to a control group. Those in the aromatherapy group received 50 cc of a mixture of three percent lavender oil and 97% sweet almond oil. The placebo control group received only almond oil. All subjects were asked to massage the affected knee nine times within three weeks, at a fixed time of day, while sitting in a chair. The control group received no massage. All were assessed with the WOMAC OA Index, at baseline, immediately after the treatment, then one and four weeks after the intervention.

Immediately and at one week after intervention, the aromatherapy group had significant better ADL scores than did the control group ( $p=0.001$  and  $p=0.03$ , respectively). However, the significance was not sustained at four weeks.

**Conclusion:** This study of patients with osteoarthritis of the knee suggests that lavender essential oil massage may have a positive but short term effect on disability.

Nasiri, A., et al. Aromatherapy Massage with Lavender Essential Oil in the Prevention of Disability

and ADLs in Patients with Osteoarthritis of the Knee: A Randomized, Controlled Clinical Trial. *Complement Ther Clin Pract* 2018, February; 30: 116-121.

### PREDICTORS OF SUCCESSFUL OUTCOMES AFTER HYALURONIC ACID INJECTIONS OF THE KNEE

Hyaluronic acid (HA) injections are commonly performed for patients with knee osteoarthritis (OA). However, studies of the effectiveness of these injections have produced mixed results. This study was designed to determine which factors best predict a successful outcome among those injected with HA for OA of the knee.

This prospective, observational study included 102 patients with OA of the knee. Twenty-six patients (25%) had KL grade I OA, 32 (31%) had grade II OA and 44 (43%) had grade III OA. All participants completed standardized surveys, including a visual analog scale (VAS) for pain and the Knee Injury and Osteoarthritis Outcome score (KOOS). Treatment success was defined as a minimum of 20-point improvement on the 100-point VAS or improvement in at least half of the Knee Injury and Osteoarthritis Outcome score (KOOS) categories of pain, symptoms, function and quality of life. The subjects received one HA injection per week for three weeks, with surveys completed at each injection and at three months after the final injection.

Of the 102 patients, 57% had a successful response. Those with grade I or grade II OA were significantly more likely to respond to injections than were patients with grade III OA ( $p=0.001$ ). Those who responded positively to the first injection were 2.3 times more likely to have a positive response at follow-up ( $p=0.001$ ). Among patients with grade II OA, those over 60 years of age were two times more likely to respond than were those who were younger ( $p=0.009$ ). There was no significant effect on response to treatment by smoking status, body mass index, gender, race, brand of injection or initial survey score.

**Conclusion:** This study of patients with osteoarthritis of the knee found that factors associated with a better long-term response to hyaluronic acid injections were grade I or II OA, a positive response to the first of three injections, and age over 60 years.

Bowman, E., et al. Hyaluronic Acid

Injections for Osteoarthritis of the Knee: Predictors of Successful Treatment. *Int Orthop*. 2018, April; 42(4): 733-740.

### PROGNOSIS OF PRESSURE ULCERS AFTER HIP FRACTURE

After a fragility hip fracture (a fracture which occurs with minimal trauma), estimates of the risk of skin pressure injury vary from 8.8% to 55%. This study was designed to identify predictive factors of pressure ulcers among elderly individuals hospitalized with fragility hip fractures.

This prospective study included elderly patients admitted to the emergency department with a diagnosis of fragility hip fracture. The subjects were followed for the occurrence of pressure ulcers, with secondary outcomes including mortality within 30 days, surgical complications, urinary tract infections, pneumonia and lateral popliteal or sciatic nerve paralysis. Variables thought to be related to the onset of hip fractures were divided into intrinsic properties, extrinsic properties (thickness of stretcher mattress in the emergency department, degree of pain, type of surgery, ICU admission days, restraints used and hospital equipment used to prevent ulcers), and hospital organization (time from fracture to emergency department, length of stay in the emergency department and time from arrival to surgery).

Subjects were 467 adults 65 years of age and older with a mean hospital length of stay of nine days. Of the 127 patients who developed a pressure ulcer, 46 were grade two or higher, with a higher incidence among those 81 years of age and older. Correcting for age, the multivariate analysis found that factors independently associated with the onset of skin ulcers were bone fixation surgery ( $p=0.012$ ) and placing the limb in a foam rubber splint ( $p<0.0005$ ). The use of an alternate pressure mattress was associated with a reduced risk.

**Conclusion:** This study of patients with fragility fracture found that issues associated with the risk of pressure ulcers included age greater than 81 years, bone fixation surgery and an increased time with the use of a rubber splint.

Forni, C., et al. Prospective Prognostic Cohort Study of Pressure Injuries in Older Adult Patients with

Hip Fractures. **Adv Skin Wound Care.** 2018, May; 31(5): 218-224.

### REDEFINING SACROILIITIS

As low-grade bone edema (BME) in the sacroiliac (SI) joints has been reported in up to 25% of healthy adults with nonspecific low back pain, the diagnostic utility of magnetic resonance imaging (MRI) to discriminate these features from early spondyloarthritis becomes uncertain. This study explored the frequency and distribution of BME and structural lesions in the SI joints of athletes from a variety of sports.

Subjects were 20 healthy, recreational runners and 22 healthy, professional hockey players, 18 to 40 years of age. All underwent MRI evaluation of the SI joint, with blinded determinations of sacroiliitis as proposed by the Assessment of Spondyloarthritis International Society (ASAS). For this analysis, each SI joint was divided into eight joint quadrants. Lesions were compared by groups and by location.

The mean numbers of SI joint quadrants demonstrating BME were 3.1 in recreational runners and 3.6 in hockey players. The most

affected region was the posterior lower ilium, followed by the anterior upper sacrum. The proportions of subjects meeting the definition for active sacroiliitis were 35% of the recreational runners before running, 30% after running, and 40.9% of the hockey players. The mean numbers of SI joint quadrants affected by BME were 5.4 and 6.3 in recreational runners before and after running, respectively, and 5.8 in hockey players.

**Conclusion:** Using the ASAS definition, this study of recreational runners and elite hockey athletes found MRI evidence of active sacroiliitis in 30-41%.

Weber, U., et al. Frequency and Anatomic Distribution of Magnetic Resonance Imaging Features in the Sacroiliac Joints of Young Athletes. Exploring Background Noise towards a Data-Driven Definition of Sacroiliitis in Early Spondyloarthritis. **Arthr Rheumatol.** 2018, May; 70 (5): 736-745.

*Musculoskeletal in Review (MSK)* is produced by physicians specializing in musculoskeletal and neurological medicine, with the cooperation and assistance of Emory University School of Medicine. Summaries appearing in this publication are intended as an aid in reviewing the literature relevant to the practice of clinical musculoskeletal medicine. The summaries appearing in this publication are intended as an aid in reviewing the broad base of literature relevant to this field.

These summaries are not intended for use as the sole basis for clinical treatment, or as a substitute for the reading of the original research.

*MSK* is affiliated with the World Health Organization and multiple national medical societies worldwide.

Private subscriptions are available by email at [mkskinreview@aol.com](mailto:mkskinreview@aol.com) or by phone at (417) 779-9101.



## **MUSCULOSKELETAL IN REVIEW**

**Produced by the Department of  
Rehabilitation Medicine, Emory  
University School of Medicine**

**Expanding the frontier of medicine in research, teaching, and patient care**