

# REHAB IN REVIEW

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## TRAUMATIC BRAIN INJURY AND STROKE RISK

Traumatic brain injury (TBI) often causes impairment to the vascular system, which supplies blood and nutrients to the cells of the brain. Some have speculated that, as damage to the brain includes the vascular system, TBI might further trigger the occurrence of cerebrovascular accidents. This study was designed to determine whether cerebrovascular damage from TBI is a predisposing factor for future stroke.

This nationwide, prospective, population based study used data from the Longitudinal Health Insurance Database, released annually by the Taiwan National Health Research Institute. A total of 23,199 subjects included those hospitalized with a principal diagnosis of TBI within a three-year period. A control group of 69,597 individuals without TBI, was matched for gender, age and year of index use of the health care system. The two groups were compared for incident stroke.

After matching for age and gender, patients with TBI were more likely to have hypertension ( $p < 0.001$ ), diabetes ( $p < 0.001$ ), coronary heart disease ( $p < 0.001$ ), atrial fibrillation ( $p < 0.001$ ) and heart failure ( $p < 0.001$ ) than were those in the control group. Compared to the control group, patients with TBI had significantly higher rates of stroke at three months, one year and five years ( $p < 0.001$  for all comparisons). The hazard ratios of stroke for patients with TBI were 10.2 times as high within three-months, 4.6 times as high within one year and 2.3 times as high within five years ( $p < 0.001$  for all comparisons).

**Conclusion:** This study of patients with traumatic brain injury found that the risk of stroke is elevated for at least five years post-injury.

Chen, Y., et al. Patients with Traumatic Brain Injury: Population-Based Study Suggests Increased Risk of Stroke. *Stroke*. 2011, October; 42: 2733-2739.

## CHOCOLATE AND STROKE RISK IN WOMEN

Chocolate consumption has been found to reduce blood pressure, improve endothelial and platelet function and improve insulin resistance. Flavonoids in chocolate possess strong antioxidant activity and can suppress the oxidation of low-density lipoprotein cholesterol. This study examined the association between chocolate consumption and stroke risk.

Data were obtained from the population-based Swedish Mammography Cohort. In the autumn of 1997, 33,372 women, ages 49 to 83, completed questionnaires concerning diet and lifestyle factors. Chocolate consumption was assessed using a self-administered food frequency questionnaire, with subjects indicating their average chocolate consumption over the prior year. Incident cases of first stroke which occurred between January 1, 1998, and December 31, 2008, were obtained from the Swedish Hospital Discharge Registry. Stroke events were classified as cerebral infarctions, intracerebral hemorrhages, subarachnoid hemorrhages or unspecified strokes.

During the 10-year follow-up, 1,549 strokes were identified. Chocolate consumption was inversely associated with the risk of total stroke, cerebral infarction and hemorrhagic stroke. The relative risks for a 50 gram per week increase in chocolate consumption were 0.864 for total stroke, 0.88 for cerebral infarction and 0.73 for hemorrhagic stroke.

**Conclusion:** This study identified a statistically significant, inverse

association between chocolate consumption and subsequent stroke. Interestingly, only women in the highest quartile of chocolate consumption (a median of 66.5 grams/wk.) had a significantly reduced risk of stroke.

Larsson, S., et al. Chocolate Consumption and Risk of Stroke in Women. *J Am Coll Cardiol*. 2011, October 18; 58(17): 1828-1829.

## ULTRASOUND DETECTED FASCICULATIONS AND AMYOTROPHIC LATERAL SCLEROSIS

Early diagnosis of amyotrophic lateral sclerosis (ALS) is often difficult. To improve the sensitivity of diagnostic criteria, an international consensus meeting was held in Awaji-shima, Japan. In that meeting, fasciculations were introduced as evidence of acute denervation in the presence of chronic neurologic changes on needle electromyography (EMG). Previous studies have shown that ultrasound (US) may be more sensitive in detecting fasciculations than EMG in lower motor neuron disease and peripheral neuropathy. This study investigated the diagnostic value of US in ALS.

One hundred ten patients with suspected ALS were prospectively enrolled from an EMG clinic at Chiba University Hospital in Japan. Using revised criteria to diagnose ALS, 29 patients were excluded. In the remaining 81 patients, needle EMG and US were performed for all subjects to detect fasciculations. Six muscles were tested, including the tongue, biceps, first dorsal interosseous, T-10 paraspinal muscles, vastus lateralis and tibialis anterior. The results of these examinations were compared.

The number of muscles showing fasciculations was significantly greater with US than with EMG

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( $p < 0.0001$ ). Of the 81 patients, fasciculations were detected in 98% by US and in 80% by EMG ( $p = 0.02$ ). For the tongue, fasciculations could not be detected in any of the 81 patients by EMG. In contrast, US demonstrated fasciculations in 60% of the patients. The proportion of patients with definite ALS according to the Awaji criteria increased from 31% with only EMG to 53% with a combination of EMG and US.

**Conclusion:** This study of patients with suspected ALS found that ultrasound is more sensitive than electromyography in detecting fasciculations, and could be used to increase the diagnostic sensitivity of ALS.

Misawa, S., et al. Ultrasonographic Detection of Fasciculations Markedly Increases Diagnostic Sensitivity of ALS. *Neurol.*, 2011, October 18; 77 (16): 1532-1537.

### **CYTISINE FOR SMOKING CESSATION**

Tobacco smoking is highly addictive, with more than 95% of unaided attempts at cessation failing to last for six months. Success in quitting is increased by behavioral support and by a range of pharmacotherapies. However, many of these agents are quite expensive. Cytisine has been available in former socialist economy countries for more than 40 years, costing six to fifteen dollars for a course of treatment. While previous studies have suggested that Cytisine may be effective in helping smokers stop, no large, placebo-controlled, randomized trials have addressed this. This study was designed to assess the efficacy of Cytisine as a medication for smoking cessation.

This single center, double-blind, parallel group study was conducted at the smoking cessation clinic of the Maria Sklodowska-Curie Memorial Cancer Center in Warsaw, Poland. Participants were adults who smoked 10 or more cigarettes per day and were willing to attempt to stop smoking permanently. The subjects were randomized to receive placebo tablets or Cytisine. The Cytisine group received six 1.5 mg. tablets per day for three days, five per day for nine days, four per day for four days, three per day for four days and two per day for the final five days. The

primary outcome measure was 12 months of abstinence after the end of treatment.

At 12 months, abstinence rates were 8.4% in the treatment group and 2.4% in the placebo group ( $p = 0.0001$ ). Seven serious events occurred, including four in the treatment group and three in the placebo group. Five deaths were documented, two in the treatment group due to lung cancer and cardiac arrest, and three in the placebo group due to lung cancer, hemorrhagic stroke and chronic obstructive pulmonary disease. Among minor events, gastrointestinal disorders were reported more frequently in the treatment group than in the placebo group.

**Conclusion:** This trial, involving patients wishing to discontinue cigarette smoking, found that Cytisine is more effective than placebo for cessation.

West, R., et al. Placebo-Controlled Trial of Cytisine for Smoking Cessation. *N Eng J Med.* 2011, September 29; 365(13): 1193-1200.

### **TERIFLUNOMIDE FOR RELAPSING MULTIPLE SCLEROSIS**

Teriflunomide is the active metabolite of leflunomide, which reduces T and B cell activation, proliferation and function in response to autoantigens. Teriflunomide has been found to delay disease onset, reduce relapses and improve neurologic findings in studies of experimental autoimmune encephalomyelitis. This study evaluated the efficacy and safety of Teriflunomide in reducing the frequency of relapses and progression of physical disability in patients with relapsing multiple sclerosis (MS).

This study included 1,088 patients with MS, ages 18 to 55 years, who had experienced at least one relapse of MS in the prior year, or two relapses in the previous two years. The patients were randomized to receive a once daily oral dose of placebo, 7 mg of Teriflunomide or 14 mg of Teriflunomide for 108 weeks. Randomization was stratified according to the Expanded Disability Status Scale (EDSS). The primary outcome measure was the annual relapse rate, defined as the number of confirmed relapses per patient per

year. Secondary outcome measures included the progression of disability over the study period, as assessed by the changes in EDSS scores.

A total of 796 patients completed the study, with similar proportions in the three study groups. Teriflunomide significantly reduced the annualized relapse rate at either 7 mg or 14 mg as compared with placebo ( $p < 0.001$  for both comparisons). In both Teriflunomide groups, the time to first relapse was longer, and more patients remained free of relapse than in the placebo group. The proportions of patients with confirmed progression of disability were 27.3%, 21.7% and 20.2% with placebo, Teriflunomide at 7 mg and Teriflunomide at 14 mg, respectively ( $p = 0.08$  and  $p = 0.03$ , respective comparisons with placebo). In addition, the change in total lesion volume, as measured by magnetic resonance imaging, was significantly lower in the two Teriflunomide groups than in the placebo group ( $p = 0.03$  and  $p < 0.001$ , respectively).

**Conclusion:** In this study of patients with relapsing multiple sclerosis, oral Teriflunomide was found to be effective in reducing relapse rates, progression of disability, and MRI evidence of disease activity.

O'Connor, P et al. Randomized Trial of Oral Teriflunomide for Relapsing Multiple Sclerosis. *N Eng J Med.* 2011, October 6; 365(14): 1293-1303

### IMPACT OF FEAR AND CHRONIC LOW BACK PAIN

Low back pain (LBP) has reached epidemic proportions in the industrialized world. Treatment strategies often shift from pain relief to pain management. However, few interventions have proven successful in treating acute LBP. Some have suggested that treatment failures may be related to an overly broad classification system. This study sought to describe the occurrence and the association of fear avoidance model variables in patients with specific or nonspecific, chronic LBP.

This prospective study included 147 consecutive patients examined by an orthopedic surgeon, each diagnosed as having chronic LBP. The subjects were classified as having specific LBP if the pain could be attributed to recognizable, known, specific pathology. These categories

included disc herniation, isthmic spondylolisthesis and spinal stenosis. Before the initial visit, the participants completed questionnaires regarding age, pain duration, pain intensity, disability, subjective rating of kinesiophobia and depressed mood. The data were analyzed to determine how well three independent variables predicted levels of disability. These factors were back pain intensity, measured on a visual analogue scale, kinesiophobia, measured with the Tampa Scale of Kinesiophobia (TSK) and depression, measured using the Zung Self-Rating Depression Scale (SDS).

In both groups, elevated values were found on the fear avoidance model variables. In the specific, chronic LBP group, 75% of the patients reported having a disability, 60% had kinesiophobia and 80% had depressed mood. In the nonspecific, chronic LBP group, 85% reported having a disability, 70% had kinesiophobia and 80% had depressed mood. The fear avoidance variables were found to predict disability in both groups. In the specific group, all independent fear avoidance variables contributed to predict disability among those with chronic LBP. In the group with nonspecific pain, all variables except kinesiophobia contributed to the prediction of disability.

**Conclusion:** This study of patients presenting with chronic low back pain found that pain intensity, depression and kinesiophobia strongly predict disability.

Lundberg, M., et al. The Impact of Fear Avoidance Model Variables on Disability in Patients with Specific or Nonspecific, Chronic Low Back Pain. *Spine.* 2011, September 1; 36(19): 1547-1553.

### PAIN RELATED FEAR AND AVOIDANCE FOLLOWING DELAYED ONSET MUSCLE SORENESS

Pain-related fear has emerged as a predictor of pain and disability in the acute, subacute, and chronic stages of back pain. This study examined the prospective relationship between pain related fear and physical performance in healthy individuals after experiencing an experimental induction of back pain.

Thirty subjects with no history of back pain, ranging in age from 18 to 24 years, were studied. All underwent baseline assessments, including the Pain Anxiety Symptoms Scale Escape /Avoidance Subscale (PASS) and the Tampa Scale for Kinesiophobia (TSK).

After baseline evaluation, using a lumbar exercise machine, the participants were asked to perform an exercise protocol designed to induce delayed onset muscle soreness (DOMS) to the trunk extensor muscles. Upon their return, participants rated their current pain and completed the measure of DOMS-related interference. Participants then repeated the test of maximal trunk extensor performance. A hierarchical regression analysis was conducted to examine the relative contributions of demographic, pain and fear-related variables on performance at baseline and after DOMS sessions.

Pain-related fear was not significantly related to strength production prior to the induction of DOMS. Following the induction of DOMS, pain-related fear predicted reduced maximal strength production, and increased pain-related interference in life activities. Current pain intensity scores accounted for only four percent of the variance, while TSK scores accounted for 44% of the variance in predicting interference in life activities.

**Conclusion:** This study, examining the relationship between pain-related fear, physical performance, and pain-related interference found that pain-related fear is a significant predictor of outcome after the onset of pain.

Trost, Z., et al. Pain-Related Fear and Avoidance of Physical Exertion following Delayed Onset Muscle Soreness. *Pain.* 2011, July;152(7): 1540-1547.

### CERVICAL STRENGTH AND HEAD IMPACT BIOMECHANICS

Very little is known about the forces which cause mild traumatic brain injury (TBI) and methods to reduce head impact forces. Some have speculated that cervical muscle strength may reduce the risk of mild TBI, by decreasing acceleration forces to the head during a collision. This study investigated whether

greater cervical muscle strength results in lower head acceleration during impact.

Thirty-seven youth hockey players with an average age of 15 years were recruited from two AAA level travel teams. The rules in this league permitted body checks during competition. Cervical muscle strength was measured prior to the season using a handheld dynamometer, assessing the anterior neck flexors, cervical rotators, posteriolateral neck extensors, anterolateral neck flexors and upper trapezius.

These measures were normalized to the player's mass and body size. During the season, the players wore helmets with six accelerometers to measure forces of impact. Outcome measures included linear head acceleration, rotational acceleration and Head Impact Telemetry (HIT) profiles. The latter were defined as weighted composite scores, including linear and rotational acceleration, impact duration and impact location data.

Baseline cervical muscle strength was averaged, and the players were divided into three groups (high, moderate or low strength). Over 98 games and 99 practices, a total of 7,770 impacts occurred. Upon comparing cervical strength to linear and rotational acceleration, no significant differences were seen in either acceleration type between low, moderate and high cervical strength groups. However, athletes with greater upper trapezius strength were found to have worse HIT scores.

**Conclusion:** This prospective study of youth hockey players did not find that increased cervical strength mitigates against head acceleration forces during collisions.

Mihalik, J., et al. Does Cervical Muscle Strength in Youth Ice Hockey Players Affect Head Impact Biomechanics? *Clin J Sport Med.* 2011, September; 21(5): 416-420.

### COGNITIVE IMPAIRMENT AND MORTALITY

Previous studies have demonstrated that severe dementia associated with Alzheimer's disease is related to an increased mortality rate. However, less is known concerning whether mild cognitive impairment has a similar impact on mortality. This study evaluated

whether cognitive impairment is independently associated with long-term mortality among individuals 60 years of age or older.

This retrospective study included a cohort of 3,957 subjects, ages 60 to 102 years, presenting to a general medicine practice. All were screened with the Short Portable Mental Status Questionnaire (SPMSQ), a 10-question survey regarding short- and long-term memory, orientation, knowledge of current events and mathematical tasks. Depression and problematic alcohol use were also assessed. Survey results, as well as information regarding demographics, comorbidities, smoking history and body weight were obtained from electronic medical records. The researchers collected mortality data by requesting information from the National Death Index through December of 2006.

Over the observation period, the mortality rates for subjects with no cognitive impairment, mild cognitive impairment and moderate to severe cognitive impairment were 57.4%, 68.1%, and 78.6%, respectively. The median survival periods were 138, 106 and 63 months, respectively.

**Conclusion:** This study suggests that all levels of cognitive impairment, as determined by a single screening assessment, are associated with increased long-term mortality.

Sachs, G., et al. Cognitive Impairment: An Independent Predictor of Excess Mortality. *Ann Intern Med.* 2011, Sept 6; 155(5): 300-308.

### COGNITIVE IMPAIRMENT IN MULTIPLE SCLEROSIS

The progression of cognitive impairment in patients with multiple sclerosis (MS) is thought to be an important contributor to disability. Previous studies have demonstrated that patients suffer cognitive impairment even if diagnosed with clinically isolated syndrome (CIS). This study was designed to assess cognitive decline within the first five years of the diagnosis of MS, and the prognostic role of magnetic resonance imaging (MRI).

Twenty-four patients diagnosed with CIS were recruited. All subjects were between the ages of 18 and 45 years, had a diagnosis of CIS suggestive of an inflammatory

demyelinating event in the central nervous system, had oligoclonal bands confirmed by cerebral spinal fluid analysis, and had two or more lesions in the brain or spinal cord at the time of the initial MRI. A neuropsychological battery was performed at baseline and at year five, both in the patients and in a control group. In addition, MRI was performed at baseline, year one and year five.

At year five, 23 of the 24 patients fulfilled the McDonald's criteria for MS. Neuropsychological results revealed that 29% of the patients were cognitively impaired at baseline, and that 54% were cognitively impaired at year five. The T2 lesion load at baseline was shown to be a significant predictor of cognitive function at year five ( $p=0.006$ ).

**Conclusion:** This study of patients with multiple sclerosis demonstrates that cognitive decline occurs in the very first stage of the disease, with tremendous progression over the next five years.

Reuter, F., et al. Frequency of Cognitive Impairment Dramatically Increases during the First Five Years of Multiple Sclerosis. *J Neurol Neurosurg Psychiatry.* 2011, October; 82(10): 1157-1159.

### ACIDIC FIBROBLAST GROWTH FACTOR FOR SPINAL CORD INJURY

Acidic fibroblast growth factor (aFGF), in conjunction with a peripheral nerve graft, has been found to be beneficial in the repair of complete thoracic spinal cord transections in rodents. The success of connecting gray and white matter of a transected spinal cord is usually not clinically applicable due to the scarcity of such transection injuries in actual clinical practice. The repair strategy has been modified accordingly, sparing the need for peripheral nerve grafting. This study tested the efficacy and safety of aFGF, in combination with surgery, for patients with spinal cord injury.

This prospective, unlabeled, uncontrolled clinical trial included 60 patients with spinal cord injury, ages 16 to 68 years, with an injury duration of longer than 10 weeks. The aFGF was applied with fibrin glue and duraplasty via laminectomy. A booster of combined aFGF and fibrin

glue was administered at three and six months post-surgery via lumbar puncture. A comprehensive rehabilitation program was started after surgery and included bowel and bladder training, sensory and motor function and physical and occupational therapy. The patients were evaluated before and after surgery, as well as at three, six, 12, 18 and 24 months, using the ASIA Impairment Scales and the Functional Independence Measure (FIM).

Forty-nine patients completed the trial. At 12 and 24 months, ASIA motor scores had improved significantly among those with cervical injuries, as well as among those with thoracic injuries ( $p < 0.001$  for both comparisons). At 24-month follow-up, ASIA Impairment scores had improved significantly in the cervical, thoracic and thoracolumbar groups ( $p = 0.011$ ,  $p = 0.003$  and  $p = 0.001$ , respectively). On the FIM, the average sum of motor items improved at each follow-up point in the cervical and thoracolumbar groups ( $p < 0.05$  for both). The walking/wheelchair locomotion subscale scores of the FIM revealed increases in the percentages of patients who were ambulatory in both the cervical and thoracolumbar groups.

**Conclusion:** This uncontrolled clinical trial of patients with acute or chronic spinal cord injuries found that the application of aFGF was safe and was related to significant improvements in motor and sensory scores, neurologic levels and scores on impairment scales at 24 months post-treatment.

Wu, J., et al. Acidic Fibroblast Growth Factor for Repair of Human Spinal Cord Injury: A Clinical Trial. *J Neurosurg Spine*. 2011, September; 15(3): 216-227.

### RECOVERY AFTER SPINE SURGERY

Spinal surgery is among the most common inpatient surgical procedures in the United States. Despite advances in surgical techniques, outcomes realized by those surgeries remain highly variable. Recent studies have emphasized the importance of individual participation and responsibility in recovery. This study was designed to determine the

association between preoperative patient activation and functional recovery.

This investigation included patients seen between 2005 and 2006 for the surgical treatment of degenerative lumbar spine stenosis. All subjects were at least 18 years of age. Patient activation was operationally defined as an individual's propensity to engage in positive health behavior, as measured by the Patient Activation Measure, and categorized as one of four stages. In addition, the patients were assessed for levels of pain and disability and functional status. Comparisons were made as a function of patient activation, measured before surgery.

Patients with stage IV activation showed significantly greater declines in pain at follow-up than did those with stage I ( $p = 0.029$ ). Those with the highest stage of activation experienced a greater reduction in disability than did those in the lowest stage ( $p = 0.035$ ). Finally, those at the highest stage of physical activation experienced greater improvement in physical health than did those at the lowest stage ( $p = 0.044$ ).

**Conclusion:** This study of patients undergoing spine surgery found that those with a high level of positive health behavior before surgery experienced more improvements in pain, disability and physical health than did those with low levels of health behavior.

Skolasky, R., et al. Patient Activation and Functional Recovery in Persons Undergoing Spine Surgery. *J Bone Joint Surg*. 2011, September 21; 93 (18): 1665-1671.

### SPINE SURGERY AND PAIN

With the rates of spinal surgeries increasing, there is growing interest in evaluating postoperative outcomes and preventing negative outcomes. Studies have documented that up to 40% of patients with spinal stenosis who are treated surgically report residual chronic pain and restrictions in functional activity. This study assessed the effect of fear of movement on the outcomes of these surgical procedures.

This study employed 144 individuals with confirmed degenerative spine conditions who were scheduled to undergo a

procedure. Ninety-two were treated surgically for lumbar degeneration and 49 for cervical degeneration. All were evaluated for fear of movement before surgery, after surgery and at six weeks and three months. The investigators used the Tampa Scale of Kinesiophobia to rate fear of movement and controlled for confounding variables.

There was a significant decrease in fear of movement beliefs from baseline to 6 weeks as well as from 6 weeks to 3 months ( $p < 0.001$ ). Preoperative fear of movement was not a significant predictor of postoperative outcomes. However, patients who met the criteria for high postoperative fear of movement beliefs had poorer outcomes at both 6 weeks and 3 months after hospital discharge ( $p < 0.001$ ). In addition, postoperative fear of movement was associated with postoperative pain intensity, pain interference, disability, and physical health.

**Conclusion:** This study of patients undergoing spine surgery for degenerative conditions found that postoperative fear of movement is significantly associated with worse postoperative outcome.

Archer, K., et al. The Effect of Fear of Movement Beliefs on Pain and Disability after Surgery for Lumbar and Cervical Degenerative Conditions. *Spine*. 2011, September 1; 36(19): 1554-1562.

### DYSPHAGIA AFTER CERVICAL SPINAL CORD INJURY

Dysphagia is a frequent complaint among patients with cervical spinal cord injury (SCI). Given that aspiration is a major risk factor for hospital acquired pneumonia, and given that patients with SCI frequently have respiratory problems, this study was designed to further explore swallowing function in patients with cervical SCI.

Data were retrospectively retrieved from the Yonsei Rehabilitation Hospital in Seoul Korea between May of 2001 and May of 2008. Medical records were reviewed to verify history of SCI, tracheostomy and pneumonia. Subjects were interviewed in order to identify symptoms of dysphagia. All patients underwent videofluoroscopic swallowing studies, with results compared with the clinical data.

This study included 121 patients with cervical SCI. A total of 35 (28.9%) showed signs indicating dysphagia. Seventy demonstrated abnormal findings on the videofluoroscopy studies, with 10 showing evidence of aspiration. Aspiration was significantly related to older age, the presence of a tracheostomy at the time of the study, and signs and symptoms of dysphagia. Incidence of aspiration did not differ by etiology of injury, ASIA classification or spinal surgical procedure. Of the 10 patients with aspiration, four did not report symptoms of dysphagia and two did not show clinical signs of dysphagia.

**Conclusion:** This study of patients with cervical spinal cord injury found that, while 29% demonstrate signs of dysphasia, only 8.3% show evidence of aspiration on videofluoroscopy.

Shin, J., et al. Dysphagia in Cervical Spinal Cord Injury. **Spinal Cord**. 2011, September; 49(9): 1008-1013.

#### DOSE RESPONSE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND COGNITIVE FUNCTION

Rapid population aging is now a worldwide phenomenon. Dementia is a major cause of morbidity among older people. As moderate exercise has been established as a protective factor against cognitive decline, this study explored the dose response association between physical activity and cognitive decline.

This study included subjects participating in the Guangzhou Biobank Cohort Study, which randomly selected participants from a large social and welfare association. A total of 27,651 individuals 50 to 85 years of age were recruited for participation. All subjects provided detailed information concerning physical activity, with metabolic equivalent values (METs) calculated. Based upon these calculations, the subjects were classified as physically active, moderately active, or inactive. Data were also obtained in an effort to determine anthropometrics, socioeconomic position, lifestyle and disease history. Cognitive function was assessed with the Delayed 10-Word Recall Test (DWRT). Mild cognitive impairment was defined as a score of less than four of 10.

Physical activity calculations revealed that 53.1% were physically active, 42.4% moderately active and 4.5% inactive. After adjusting for potential confounders, greater levels of physical activity were significantly associated with improved DWRT scores. This association was more pronounced among those with poor self-rated health. In this group, those in the highest quintile of physical activity had a 28% lower risk of mild cognitive impairment than did those in the lowest quintile.

**Conclusion:** This large Chinese study found a dose response relationship between physical activity and cognitive function among older adults.

Xu, L., et al. Dose Response Relation between Physical Activity and Cognitive Function: Guangzhou Biobank Cohort Study. **Ann Epidemiol**. 2011, November; 21(11): 857-863.

#### MINIMAL PHYSICAL ACTIVITY AND EXTENDED LIFE EXPECTANCY

While much evidence suggests that 150 minutes or more per week of exercise can have substantial health benefits, this remains an underused public health intervention. Identification of the minimum amount of exercise sufficient to reduce mortality is a desirable goal. This study assessed the health benefits of different volumes of physical exercise.

In this historical, prospective cohort study, 416,175 healthy individuals were identified, ages 20 years or older, each of whom participated in a standard medical screening program. These subjects were followed up between 1996 and 2008. Each participant completed a self-administered questionnaire concerning medical history and lifestyle information. Through these results, physical activity level was assigned a metabolic equivalent value (MET) of 2.5 for light, 4.5 for moderate, 6.5 for medium vigorous or 8.5 for high vigorous exercise. Physical activity at work was also determined. Mortality risk was compared among the different exercise groups.

Compared with individuals in the inactive group, those on the low volume activity group who exercised

an average of 15 minutes per day had a 14% reduced risk of all cause mortality and a three-year longer life expectancy. For every additional 15 minutes of daily exercise, up to 100 minutes per day, there was an additional reduction of 4% all cause and a 1% reduction of all cancer mortality. Compared with individuals in the inactive group, at age 30, life expectancy for individuals in the low volume activity group was 2.55 years longer for men and 3.1 years longer for women.

**Conclusion:** This study demonstrates that individuals who average 15 minutes of moderate intensity exercise per day can realize significant health benefits as compared to those who are inactive.

Wen, C., et al. Minimum Amount of Physical Activity for Reduced Mortality and Extended Life Expectancy: A Prospective Cohort Study. **Lancet**. 2011, October 1; 378: 1244-1253.

#### PHYSICAL TRAINING FOR OVERUSE INJURY

Muscle and tendon injuries are a common adverse outcome of physical activity. The treatment of these injuries is challenging, and recurrent injuries are common. Adductor-related groin pain is common among physically active individuals. In a randomized, clinical trial, a training program which included strength training resulted in a return of nearly 80% of athletes to their previous sport without any residual groin pain. This study assessed the long-term effect of such a program.

Between 1991 and 1995, 59 athletes with long-standing, adductor related groin pain were randomly assigned to an active training program or a passive training program. Active training included strength training of the adductor, abdominal and low back muscles, combined with coordination and balance exercises over a period of eight to 12 weeks. The passive training group received laser treatment, friction massage, stretching and transcutaneous electrical nerve stimulation. Outcome measures included pain at palpation of the adductor muscles, groin pain with athletic activity and return to sport without groin pain.

In the original study, 79% of the athletes in the active group returned to the previous level of sport without any groin pain, as compared with 14% in the control group. At eight- to 12-year follow-up, the majority of participants had reduced their level of activity, although no significant difference was found between the two groups. Upon assessing treatment outcome as poor, fair, good or excellent, a significant difference was seen between the groups in favor of active treatment ( $p=0.047$ ).

**Conclusion:** This prospective, long-term study of patients with long-standing adductor related groin pain found that active treatment may have greater long-standing positive effects on recovery than passive treatment.

Homlich, P., et al. Continued Significant Effect of Physical Training as Treatment for Overuse Injury: 8- to 12-Year Outcome of a Randomized, Clinical Trial. **Am J Sport Med.** 2011, August; 20(10): 1-5.

#### RISK FACTORS FOR MENISCAL PATHOLOGY

Meniscal lesions are frequent, incidental findings in middle-aged and elderly individuals undergoing magnetic resonance imaging (MRI) of the knee. The overall prevalence of meniscal pathology ranges from 19% in women ages 50 to 59, to 56% among men ages 70 to 90 years of age. As diminishing meniscal function is a strong risk factor for knee osteoarthritis (OA) and its progression, any such pathology may be a key factor in understanding the progression of OA. This prospective study evaluated potential risk factors that may be associated with meniscal pathology.

Subjects were followed in the Multicenter Osteoarthritis Study (MOST), a large, prospective cohort study of individuals ages 50 to 79 years of age. The primary goal of this study was to identify risk factors for incident and progressive knee OA. The subjects included 3,026 individuals recruited from two communities in the United States. All recruits were at higher than average risk for knee OA. At baseline, the participants underwent MRI of the knee, with risk factor evaluation including age, gender, body mass index (BMI), bony enlargement of

finger joints, knee trauma, leg length inequality and knee alignment. Meniscal integrity on paired baseline and 30-month MRI was assessed using a five-item ordered scale.

A total of 791 knees in 644 patients had a normal medial meniscus at baseline. Of these, 77 had medial meniscal pathology on MRI at 30-month follow-up. Among that group, 31 had both a meniscal lesion and a meniscal extrusion. The lesions predominantly involved the posterior horn. Of the 77, 62 did not have a record of knee injury during follow-up. After including all of the potential risk factors in a multi-variable model, the adjusted odds ratio for medial meniscal pathology was 4.14 for knee trauma during follow-up, 1.64 for five or more bony enlargements of the finger joints, 2.0 for varus alignment of the knee, and 1.5 for a BMI of over thirty at baseline.

**Conclusion:** This prospective study found that generalized osteoarthritis, obesity and varus alignment of the knee are risk factors for the progression of medial meniscal pathology among middle-aged and elderly individuals.

Englund, M., et al. Risk Factors for Medial Meniscal Pathology on Knee MRI in Older Adults: A Multicenter, Prospective Cohort Study. **Ann Rheum Dis.** 2011, October; 70(10): 1733-1739.

#### WEIGHT LOSS AND KNEE OSTEOARTHRITIS

Epidemiological studies have found obesity to be an important risk factor for the development of knee osteoarthritis (OA). Obesity increases the load on the knee, and, when further aggravated by varus malalignment, this process can be accelerated. This study evaluated symptomatic improvement in patients with OA who were on an intensive low energy diet (LED).

This prospective, controlled trial randomized subjects to either 52 weeks of an intensive weight-loss therapy or 52 weeks of a moderate, conventional low-calorie high-protein diet, defined as the control. The LED group consumed 810 kcal/day of a nutritional power diet, administered for the first eight weeks. After eight weeks, guidance was provided to maintain a 1,200 kcal/day diet,

returning to another four weeks of the 810 kcal/day diet between weeks 32 and 36. The control group received nutritional advice, which allowed the subjects to eat a variety of ordinary foods, providing approximately 1,200 kcal/day. In addition to body weight, the participants were assessed with the Western Ontario and McMaster Universities Index (WOMAC), addressing joint pain, stiffness and limitation of physical function.

At one year, the LED group exhibited a weight loss of 10.9 kg, compared to 3.6 kg for the control group ( $p<0.0001$ ). No significant difference was noted between groups on total WOMAC indices. At one year, however, the pain subscale of the WOMAC demonstrated improvements of 7.7mm in the LED group and only 0.5mm in the control group ( $p=0.022$ ).

**Conclusion:** This study demonstrates that, among patients with knee osteoarthritis, weight-loss can significantly reduce pain.

Biddal, H., et al. Weight Loss as Treatment for Knee Osteoarthritis Symptoms in Obese Patients: One-Year Results from a Randomized, Controlled Trial. **Ann Rheum Dis.** 2011, October; 70(10): 1798-1803.

#### ST ELEVATION IN ASYMPTOMATIC ATHLETES

Electrocardiogram has become an accepted part of the preparticipation examination (PPE) of athletes. This study investigated the prevalence and patterns of ST elevation in ambulatory patients and collegiate athletes in an attempt to discriminate normal variants from those associated with cardiac disease.

In this retrospective cohort study, electrocardiograms from 12,319 outpatients were obtained from the Veterans Affairs Palo Alto Health Care System. Excluded were those with atrial fibrillation or flutter, ventricular rates of greater than 100 beats per minute, QRS durations of greater than 120 milliseconds, paced rhythms, ventricular preexcitation, Q waves, ST depression or T-wave inversion. In addition, data were obtained from PPEs for the Stanford University varsity athletes in 2007. This PPE included computerized, 12-lead ECGs from 658 athletes. The two groups were screened for ST elevation and were compared for time

(Continued from page 2)

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to cardiac mortality. The California Health Department Service and Social Security Death indices were used to ascertain the vital status of each athlete, and the Veterans Affairs computerized medical records were similarly used for the outpatient controls.

At an average of 7.9-year follow-up, adverse cardiovascular events occurred in none of the athletes and in 17% of the VA outpatients. The prevalence of ST elevation decreased with age, was higher in athletes than in age matched outpatients, and was two to 10 times higher in men than in women. Of the male athletes, 34% had at least a 2 mV elevation, as compared to less than five percent of the non-athletes ( $p < 0.01$ ).

**Conclusion:** This study found that, although highly prevalent in the athletic population, an EKG finding of a resting ST elevation (including early repolarization) is not associated with an increased risk of cardiovascular death.

Leo, T., et al. The Impact of ST Elevation on Athletic Screen. **Clin J Sport Med**; 2011, September; 21(5): 433-440.

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