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Embargoed for release on Monday, Dec. 2, 2013, at 12:01 a.m. ET

MRI Technique Reveals Low Brain Iron in ADHD Patients

AT A GLANCE

- **Researchers measured brain iron in children and adolescents with ADHD using an MRI technique called magnetic field correlation (MFC) imaging.**
- **Results showed that ADHD patients who had never been on medication had significantly lower MFC than the control group or ADHD patients who had been on psychostimulant medication.**
- **The MFC technique's ability to noninvasively detect low iron levels may help improve ADHD diagnosis and guide optimal treatment.**

CHICAGO – Magnetic resonance imaging (MRI) provides a noninvasive way to measure iron levels in the brains of people with attention deficit hyperactivity disorder (ADHD), according to a study being presented today at the annual meeting of the Radiological Society of North America (RSNA). Researchers said the method could help physicians and parents make better informed decisions about medication.

ADHD is a common disorder in children and adolescents that can continue into adulthood. Symptoms include hyperactivity and difficulty staying focused, paying attention and controlling behavior. The American Psychiatric Association reports that ADHD affects 3 to 7 percent of school-age children.

Psychostimulant medications such as Ritalin are among the drugs commonly used to reduce ADHD symptoms. Psychostimulants affect levels of dopamine, a neurotransmitter in the brain associated with addiction.

“Studies show that psychostimulant drugs increase dopamine levels and help the kids that we suspect have lower dopamine levels,” said Vitria Adisetiyo, Ph.D., postdoctoral research fellow at the Medical University of South Carolina in Charleston, S.C. “As brain iron is required for dopamine synthesis, assessment of iron levels with MRI may provide a noninvasive, indirect measure of dopamine.”

Dr. Adisetiyo and colleagues explored this possibility by measuring brain iron in 22 children and adolescents with ADHD and 27 healthy control children and adolescents using an MRI technique called magnetic field correlation (MFC) imaging. The technique is relatively new, having been introduced in 2006 by study co-authors and faculty members Joseph A. Helpert, Ph.D., and Jens H. Jensen, Ph.D.

“MRI relaxation rates are the more conventional way to measure brain iron, but they are not very specific,” Dr. Adisetiyo said. “We added MFC because it offers more refined specificity.”

The results showed that the 12 ADHD patients who had never been on medication had significantly lower MFC than the 10 ADHD patients who had been on psychostimulant medication or the 27 typically developing children and adolescents in the control group. In contrast, no significant group differences were detected using relaxation rates or serum measures. The lower brain iron levels in the non-medicated group appeared to normalize with psychostimulant medication.

MFC imaging’s ability to noninvasively detect the low iron levels may help improve ADHD diagnosis and guide optimal treatment. Noninvasive methods are particularly important in a pediatric population, Dr. Adisetiyo noted.

“This method enables us to exploit inherent biomarkers in the body and indirectly measure dopamine levels without needing any contrast agent,” she said.

If the results can be replicated in larger studies, then MFC might have a future role in determining which patients would benefit from psychostimulants—an important consideration because the drugs can become addictive in some patients and lead to abuse of other psychostimulant drugs like cocaine.

“It would be beneficial, when the psychiatrist is less confident of a diagnosis, if you could put a patient in a scanner for 15 minutes and confirm that brain iron is low,” she said. “And we could possibly identify kids with normal iron levels who could potentially become addicts.”

Along with replicating the results in a larger population of patients, the researchers hope to expand their studies to look at the relationship between cocaine addiction and brain iron.

Other co-authors are F. Xavier Castellanos, M.D., Adriana Di Martino, M.D., Kevin M. Gray, M.D., Els Fieremans, Ph.D., Ali Tabesh, Ph.D., and Rachael L. Deardorff, M.S.

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MR Spectroscopy Shows Differences in Brains of Preterm Infants

AT A GLANCE

- **Premature birth appears to trigger developmental processes in the white matter of the brain that could put children at higher risk of problems later in life.**
- **Preterm infants face an increased risk of behavioral problems, ranging from impulsiveness and distractibility to more serious conditions like autism and ADHD.**
- **There are approximately 500,000 preterm births annually in the U.S.**

CHICAGO – Premature birth appears to trigger developmental processes in the white matter of the brain that could put children at higher risk of problems later in life, according to a study being presented next week at the annual meeting of the Radiological Society of North America (RSNA).

Preterm infants—generally those born 23 to 36 weeks after conception, as opposed to the normal 37- to 42-week gestation—face an increased risk of behavioral problems, ranging from impulsiveness and distractibility to more serious conditions like autism and attention deficit hyperactivity disorder (ADHD).

“In the United States, we have approximately 500,000 preterm births a year,” said Stefan Blüml, Ph.D., director of the New Imaging Technology Lab at Children’s Hospital Los Angeles and associate professor of research radiology at the University of Southern California in Los Angeles. “About 60,000 of these babies are at high risk for significant long-term problems, which means that this is a significant problem with enormous costs.”

Dr. Blüml and colleagues have been studying preterm infants to learn more about how premature birth might cause changes in brain structure that may be associated with clinical problems observed later in life. Much of the focus has been on the brain’s white matter, which transmits signals and enables communication between different parts of the brain. While some white matter damage is readily apparent on structural magnetic resonance imaging (MRI), Dr. Blüml’s group has been using magnetic resonance spectroscopy (MRS) to look at differences on a microscopic level.

In this study, the researchers compared the concentrations of certain chemicals associated with mature white matter and gray matter in 51 full-term and 30 preterm infants. The study group had normal structural MRI findings, but MRS results showed significant differences in the biochemical maturation of white matter between the term and preterm infants, suggesting a disruption in the

timing and synchronization of white and gray matter maturation. Gray matter is the part of the brain that processes and sends out signals.

“The road map of brain development is disturbed in these premature kids,” Dr. Blüml said. “White matter development had an early start and was ‘out of sync’ with gray matter development.”

This false start in white matter development is triggered by events after birth, according to Dr. Blüml.

“This timeline of events might be disturbed in premature kids because there are significant physiological switches at birth, as well as stimulatory events, that happen irrespective of gestational maturity of the newborn,” he said. “The most apparent change is the amount of oxygen that is carried by the blood.”

Dr. Blüml said that the amount of oxygen delivered to the fetus’s developing brain in utero is quite low, and our brains have evolved to optimize development in that low oxygen environment. However, when infants are born, they are quickly exposed to a much more oxygen-rich environment.

“This change may be something premature brains are not ready for,” he said.

While this change may cause irregularities in white matter development, Dr. Blüml noted that the newborn brain has a remarkable capacity to adapt or even “re-wire” itself—a concept known as plasticity. Plasticity not only allows the brain to govern new skills over the course of development, like learning to walk and read, but could also make the brains of preterm infants and young children more responsive to therapeutic interventions, particularly if any abnormalities are identified early.

“Our research points to the need to better understand the impact of prematurity on the timing of critical maturational processes and to develop therapies aimed at regulating brain development,” Dr. Blüml said.

Co-authors are Ashok Panigrahy, M.D., Marvin D. Nelson, M.D., Lisa Paquette, M.D., and Jessica L. Wisnowski, Ph.D.

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Breast Tomosynthesis Increases Cancer Detection and Reduces Recall Rates

AT A GLANCE

- **Researchers found that digital breast tomosynthesis (DBT) led to reduced recall rates and an increase in cancer detection.**
- **The research team compared the results from 15,633 women imaged with DBT to those of 10,753 patients imaged with digital mammography.**
- **The average recall rate decreased from 10.40 percent to 8.78 percent with DBT, and cancer detection rates increased from 3.51 to 5.24 (per 1,000 patients) with DBT.**

CHICAGO – Researchers have found that digital breast tomosynthesis (DBT) led to reduced recall rates and an increase in cancer detection in a large breast cancer screening program. The results of this study were presented today at the annual meeting of the Radiological Society of North America (RSNA).

Digital mammography is the gold standard for breast cancer screening, but may yield suspicious findings that turn out not to be cancer. These false-positive findings are associated with a higher recall rate, or the rate at which women are called back for additional imaging or biopsy.

Digital breast tomosynthesis has shown promise at reducing recall rates in all groups of patients, including younger women and women with dense breast tissue. Tomosynthesis is similar to mammography in that it relies on ionizing radiation to generate images of the breast. However, unlike conventional mammography, tomosynthesis allows for three-dimensional (3-D) reconstruction of the breast tissue, which can then be viewed as sequential slices through the breast.

Because DBT technology is relatively new, it is typically used only as a supplemental screening tool, but since October 2011, every patient screened for breast cancer at Hospital of the University of Pennsylvania (HUP) in Philadelphia has been screened using DBT, according to Emily F. Conant, M.D., chief of breast imaging at HUP and the study's lead author.

“We have used DBT on all of our breast screening patients,” Dr. Conant said. “Every patient has had it—we have not selected patients because of their risk or breast density or if they were willing to pay extra. We did not charge extra and were able to provide all of our women with this new technology.”

For the study, Dr. Conant and colleagues compared imaging results from 15,633 women who underwent DBT at HUP beginning in 2011 to those of 10,753 patients imaged with digital mammography the prior year. Six radiologists trained in DBT interpretation reviewed the images.

The researchers found that, compared to digital mammography, the average recall rate using DBT decreased from 10.40 percent to 8.78 percent, and the cancer detection rate increased from 3.51 to 5.24 (per 1,000 patients). The overall positive predictive value—the proportion of positive screening mammograms from which cancer was diagnosed—increased from 4.1 percent to 6.0 percent with DBT.

“Our study showed that we reduced our callback rate and increased our cancer detection rate,” Dr. Conant said. “The degree to which these rates were affected varied by radiologist. But importantly, the ratio of callback to cancer detection rate improved significantly for our radiologists.”

Dr. Conant notes that tomosynthesis is an evolving platform, and researchers are already seeing a significant improvement in important screening outcomes.

“It’s the most exciting improvement to mammography that I have seen in my career, even more important than the conversion from film-screen mammography to digital mammography,” she said. “The coming years will be very exciting, as we see further improvements in this technology.”

Co-authors are Nandita Mitra, Ph.D., Anne Marie McCarthy, Ph.D., Despina Konto, Ph.D., Susan G. Roth, M.D., Susan P. Weinstein, M.D., Marie Synnestvedt, Ph.D., Mathew Thomas, B.S., and Fei Wan, Ph.D.

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New Research Shows Promise for Possible HIV Cure

AT A GLANCE

- **Researchers used radioimmunotherapy (RIT) to destroy remaining HIV-infected cells in the blood samples of patients treated with HAART.**
- **HAART suppresses replication of the virus but does not kill the infected cells.**
- **Using RIT, the researchers were also able to treat HIV-infected cells in the brain and central nervous system.**

CHICAGO – Researchers have used radioimmunotherapy (RIT) to destroy remaining human immunodeficiency virus (HIV)-infected cells in the blood samples of patients treated with antiretroviral therapy, offering the promise of a strategy for curing HIV infection. Results of the study were presented today at the annual meeting of the Radiological Society of North America (RSNA).

Highly active antiretroviral therapy (HAART) has transformed the outlook for patients infected with HIV by suppressing the replication of the

virus in the body. However, despite the success of HAART in effectively reducing the burden of HIV, scientists believe reservoirs of latently infected cells persist in the body, preventing the possibility of a permanent cure.

“In an HIV patient on HAART, drugs suppress viral replication, which means they keep the number of viral particles in a patient’s bloodstream very low. However, HAART cannot kill the HIV-infected cells,” said the study’s lead author, Ekaterina Dadachova, Ph.D., professor of radiology, microbiology and immunology at Albert Einstein College of Medicine in the Bronx, N.Y. “Any strategy for curing HIV infection must include a method to eliminate viral-infected cells.”

In her study, Dr. Dadachova and a team of researchers administered RIT to blood samples from 15 HIV patients treated with HAART at the Einstein-Montefiore Center for AIDS Research.

RIT, which has historically been employed to treat cancer, uses monoclonal antibodies—cloned cells that are recruited by the immune system to identify and neutralize antigens. Antigens are foreign objects like bacteria and viruses that stimulate an immune response in the body. The antibody, designed to recognize and bind to a specific cell antigen, is paired with a radioactive

isotope. When injected into the patient's bloodstream, the laboratory-developed antibody travels to the target cell where the radiation is then delivered.

“In RIT, the antibodies bind to the infected cells and kill them by radiation,” Dr. Dadachova said. “When HAART and RIT are used together, they kill the virus and the infected cells, respectively.”

For the study, Dr. Dadachova's team paired the monoclonal antibody (mAb2556) designed to target a protein expressed on the surface of HIV-infected cells with the radionuclide Bismuth-213.

The researchers found that RIT was able to kill HIV-infected lymphocytes previously treated with HAART, reducing the HIV infection in the blood samples to undetectable levels.

“The elimination of HIV-infected cells with RIT was profound and specific,” Dr. Dadachova said. “The radionuclide we used delivered radiation only to HIV-infected cells without damaging nearby cells.”

An important part of the study tested the ability of the radiolabeled antibody to reach HIV-infected cells in the brain and central nervous system. Using an in vitro human blood brain barrier model, the researchers demonstrated that radiolabeled mAb2556 could cross the blood brain barrier and kill HIV-infected cells without any overt damage to the barrier itself.

“Antiretroviral treatment only partially penetrates the blood brain barrier, which means that even if a patient is free of HIV systemically, the virus is still able to rage on in the brain, causing cognitive disorders and mental decline,” Dr. Dadachova said. “Our study showed that RIT is able to kill HIV-infected cells both systemically and within the central nervous system.”

According to Dr. Dadachova, clinical trials in HIV patients are the next step for the RIT treatment.

Co-authors are Alicia McFarren, M.D., and Dina Tsukrov, M.S.

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Cardiac MRI Reveals Energy Drinks Alter Heart Function

AT A GLANCE

- **Healthy adults who consumed energy drinks had significantly increased heart contraction rates one hour later.**
- **Researchers used cardiac MRI on 18 healthy volunteers before and after consuming an energy drink containing taurine and caffeine.**
- **Cardiac MR images obtained one hour after the volunteers consumed the energy drink revealed significantly increased contraction rates in the left ventricle.**

CHICAGO – Healthy adults who consumed energy drinks high in caffeine and taurine had significantly increased heart contraction rates one hour later, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“Until now, we haven’t known exactly what effect these energy drinks have on the function of the heart,” said radiology resident Jonas Dörner, M.D., of the cardiovascular imaging section at the University of Bonn, Germany, which is led by the study’s principal investigator, Daniel K. Thomas, M.D. “There are concerns about the products’ potential adverse side effects on heart function,

especially in adolescents and young adults, but there is little or no regulation of energy drink sales.”

Energy drinks represent a multibillion dollar industry that is growing every day. While teenagers and young adults have traditionally been the largest consumers, in recent years more people of all demographics have begun consuming energy drinks.

A 2013 report from the Substance Abuse and Mental Health Services Administration stated that in the U.S. from 2007 to 2011, the number of emergency department visits related to energy drink consumption nearly doubled, increasing from 10,068 to 20,783. Most of the cases were identified among patients aged 18 to 25, followed by those aged 26 to 39.

“Usually energy drinks contain taurine and caffeine as their main pharmacological ingredients,” Dr. Dörner said. “The amount of caffeine is up to three times higher than in other caffeinated beverages like coffee or cola. There are many side effects known to be associated with a high intake of caffeine, including rapid heart rate, palpitations, rise in blood pressure and, in the most severe cases, seizures or sudden death.”

For the study, which is ongoing, Dr. Dörner and colleagues used cardiac magnetic resonance imaging (MRI) to measure the effect of energy drink consumption on heart function in 18 healthy volunteers, including 15 men and three women with a mean age of 27.5 years. Each of the volunteers underwent cardiac MRI before and one hour after consuming an energy drink containing taurine (400 mg/100 ml) and caffeine (32 mg/100 ml).

Compared to the baseline images, results of cardiac MRI performed one hour after the study participants consumed the energy drink revealed significantly increased peak strain and peak systolic strain rates (measurements for contractility) in the left ventricle of the heart. The heart's left ventricle receives oxygenated blood from the lungs and pumps it to the aorta, which distributes it throughout the rest of the body.

“We don't know exactly how or if this greater contractility of the heart impacts daily activities or athletic performance,” Dr. Dörner said. “We need additional studies to understand this mechanism and to determine how long the effect of the energy drink lasts.”

The researchers found no significant differences in heart rate, blood pressure or the amount of blood ejected from the left ventricle of the heart between the volunteers' baseline and second MRI exams.

“We've shown that energy drink consumption has a short-term impact on cardiac contractility,” Dr. Dörner said. “Further studies are needed to evaluate the impact of long-term energy drink consumption and the effect of such drinks on individuals with heart disease.”

Dr. Dörner said that while long-term risks to the heart from drinking energy drinks remain unknown, he advises that children, as well as people with known cardiac arrhythmias, should avoid energy drinks, because changes in contractility could trigger arrhythmias. He also cautions that additional study is needed to address risks posed by the consumption of energy drinks in combination with alcohol.

Other co-authors are Daniel Kuetting, M.D., Claas P. Naehle, M.D., and Hans H. Schild, M.D.

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PRP Therapy Improves Degenerative Tendon Disease in Athletes

AT A GLANCE

- **Ultrasound-guided delivery of platelet-rich plasma (PRP) improves functionality and reduces recovery time in athletes with degenerative disease of the tendon.**
- **Researchers evaluated PRP in athletes who had degenerative tendinosis in the Achilles or patellar tendon.**
- **Pain and functionality were significantly improved in all patients after PRP therapy.**

CHICAGO – Ultrasound-guided delivery of platelet-rich plasma (PRP) improves functionality and reduces recovery time in athletes with degenerative disease in their tendons, according to a study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

PRP therapy is a recent development in which blood is collected from the patient and then spun in a centrifuge to separate the PRP from other blood components. The PRP is then injected under ultrasound guidance into the target area, where it stimulates cellular growth and healing.

The therapy has grown popular among professional athletes from a variety of sports, who are looking to avoid surgery or prolonged recovery periods. Tiger Woods, Peyton Manning, Kobe Bryant and Rafael Nadal are just a few sports superstars who are reported to have undergone PRP therapy in recent years.

“PRP enables regeneration of the tendons and reduction of pain thanks to its regenerative and anti-inflammatory properties,” said study author Alice La Marra, M.D., radiology resident at the University of L’Aquila in L’Aquila, Italy.

Dr. La Marra and colleagues recently evaluated PRP in 50 athletes who had degenerative tendinosis in the Achilles tendon, which connects the calf muscle to the heel bone, and 30 who had tendinosis in the patellar tendon, which connects the kneecap to the shin bone. Tendinosis is common in athletes and is caused by a repeating cycle of damage and repair. The Achilles and patellar tendons are common sites of tendinosis.

The patients underwent ultrasound-guided PRP every 21 days for a total of three treatments. MRI was performed before the procedures and 30 days and one year after the last treatment. The

researchers used standard measures of functionality and pain to determine the severity of the tendinosis.

Patients with tendinosis of the Achilles tendon saw an overall improvement of 80 percent in pain and 53 percent in functionality after the PRP treatment. Those patients who had tendinosis in the patellar tendon saw a 75 percent improvement in pain and a 50 percent improvement in functionality.

The signal intensity on MRI, which provides a measure of tissue integrity, normalized in 90 percent of the PRP patients.

“Our study showed that in patients who underwent PRP treatments, there was an improvement of functionality, a decrease in pain and a normalization of the signal intensity seen on MRI,” Dr. La Marra said. “Therefore, our experience proves that PRP infiltration may be a good therapeutic alternative for the treatment of Achilles and patellar tendinopathy in athletes.”

Current treatment for degenerative diseases of these tendons is based on the severity of the lesion and the age and activity level of the person, Dr. La Marra said. Common treatment options include physical therapy, corticosteroids and surgery.

“Our study showed that PRP is the better option. Compared to the other therapies, it allows a faster and more efficient recovery,” she said.

In addition, Dr. La Marra pointed out that the use of corticosteroids is risky for professional athletes, as it can result in failed drug tests.

“Considering the results obtained in recent years, we hope that the use of PRP in tendinosis becomes routine for patients who practice sports activities, even at a competitive level,” she said.

Co-authors are Carlo Masciocchi, M.D., Antonio Barile, M.D., Luigi Zugaro, M.D., Silvia Mariani, M.D., and Lorenzo Maria Gregori, M.D.

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International Study Finds Heart Disease Similar in Men and Women

AT A GLANCE

- **A large-scale international study found that men and women with similar cardiac risk profiles and disease have a similar risk of heart attack.**
- **Researchers used data from the CONFIRM Registry, which collected information on 27,725 individuals in six countries who underwent CCTA.**
- **The absence of plaque on CCTA conferred a good prognosis for both men and women.**

CHICAGO – An analysis of data from an international multicenter study of coronary computed tomography angiography (CCTA) reveals that men and women with mild coronary artery disease and similar cardiovascular risk profiles share similar prognoses. Results of the study were presented today at the annual meeting of the Radiological Society of North America (RSNA).

“We conducted this study because we wanted to understand whether men and women with the same extent of coronary artery disease and similar risk profiles have similar or dissimilar

prognoses,” said Jonathon Leipsic, M.D., FRCPC, director of medical imaging at St. Paul’s Hospital in Vancouver, British Columbia. “There is a tendency to think women’s heart disease is very different than men’s heart disease. Our data show that once plaque accumulates in the coronary arteries, the prognosis is very similar between men and women.”

Coronary artery disease occurs when the coronary arteries—the major blood vessels that supply the oxygen-rich blood to the heart muscle—begin to accumulate a buildup of fatty deposits called plaque. Over time, plaque may damage or narrow the arteries. CCTA is a noninvasive imaging test that uses computed tomography (CT) to image the amount of plaque present in the coronary arteries.

For the study, Dr. Leipsic and a team of researchers used data from the COronary CT Angiography Evaluation For Clinical Outcomes: An InteRnational Multicenter (CONFIRM) Registry, which collected information on 27,725 individuals in six countries who underwent CCTA. The registry also included participants’ traditional risk factors, allowing for the derivation of Framingham scores, which are used to determine an individual’s risk of developing cardiovascular disease.

From the registry, the researchers identified 18,158 patients without known coronary artery disease, whose CCTA results were normal or indicated nonobstructive disease, in which coronary arteries were less than 50 percent blocked. These patients, including 8,808 women and 9,350 men, were then matched on the basis of pre-existing cardiovascular risk factors and the extent of their coronary artery disease as determined by CCTA, resulting in a one-to-one cohort of 11,462 patients.

A statistical analysis of the matched cohort revealed that, controlling for all cardiovascular risk factors, nonobstructive coronary artery disease conferred a similar adverse risk of death or heart attack in both men and women. Conversely, the absence of plaque on CCTA conferred a good prognosis for both men and women. Of the patients in the cohort, only 251 experienced a heart attack or cardiac-related death during an average follow-up period of 2.3 years.

“This analysis is exciting, because this has never been shown before,” Dr. Leipsic said. “There’s a prevailing belief that mild CAD puts women at greater risk for a major cardiac event compared to men with mild CAD. Our findings show this is just not true.”

Co-authors are Stephan Achenbach, M.D., Matthew J. Budoff, M.D., Ricardo C. Cury, M.D., Gudrun Feuchtner, M.D., James Min, M.D., Leslee Shaw, Ph.D., Cameron J. Hague, M.D., Carolyn Taylor, M.D., and Gilat Grunau, Ph.D.

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Imaging Shows Long-term Impact of Blast-induced Brain Injuries in Veterans

AT A GLANCE

- **Using diffusion tensor imaging (DTI), research has shown differences in the brains of soldiers who suffered mild traumatic brain injury.**
- **The results suggest the presence of a long-term impact of blast injury on the brain.**
- **The findings showed correlation between abnormal water diffusion in the brain and problems with memory, attention and motor skills.**

CHICAGO – Using a special type of magnetic resonance imaging (MRI), researchers have found that soldiers who suffered mild traumatic brain injury (MTBI) induced by blast exposure exhibit long-term brain differences, according to a study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Recent wars have resulted in veterans with an exposure rate of approximately 20 percent to blast-induced MTBI, or trauma resulting from mortar fire and improvised explosive devices. Diagnosis can be challenging, especially in mild cases.

“Mild traumatic brain injury is difficult to identify using standard CT or MRI,” said study co-author P. Tyler Roskos, Ph.D., a neuropsychologist and assistant research professor at the Saint Louis University School of Medicine in St. Louis, Mo. “Other methods may have added sensitivity.”

One of those methods is diffusion tensor imaging (DTI), an MRI technique used to identify microstructural injury to white matter, the part of the brain that consists mostly of signal-carrying axons. Damage-associated changes in water movement along the axons are comparable in certain respects to what might happen with a garden hose, according to co-author Thomas M. Malone, B.A., research associate at Saint Louis University School of Medicine.

“As water passes through the hose from the faucet to the sprinkler, it goes in the same direction, but if you were to puncture the hose with a rake, the water would shoot out the sides,” Malone said.

In the study, researchers compared DTI-derived fractional anisotropy (FA) values in 10 veterans of Operations Iraqi Freedom and Enduring Freedom who had been diagnosed with MTBI with those of 10 healthy controls. FA measures the uniformity of water diffusion throughout the brain, and low FA tends to indicate areas of axonal injury. The average time elapsed between the blast-induced injury and DTI among the patients was 51.3 months.

“The time since injury is a novel component to our study,” Dr. Roskos said. “Most other blast-related MTBI studies examine patients in the acute phase of injury.”

Comparison of FA values showed significant differences between the two groups, and there were significant correlations between FA values and attention, delayed memory and psychomotor test scores. Since the victims were, on average, more than four years removed from their injuries, the results suggest the presence of a long-term impact of blast injury on the brain.

“This long-term impact on the brain may account for ongoing cognitive and behavioral symptoms in some veterans with a history of blast-related MTBI,” Dr. Roskos said.

The results also indicate that DTI is sensitive to group differences in blast-related MTBI even in the post-acute phase.

“DTI shows promise in enhanced sensitivity for detecting MTBI compared to MRI/CT, even in the chronic phase,” Dr. Roskos said. “Identification of changes in specific brain regions may help in diagnosis and treatment of MTBI among veterans.”

Dr. Roskos explained that this research is aimed at finding better ways for the clinician to differentiate between MTBI and PTSD in veterans in order to improve treatment.

“It makes a difference, because PTSD is psychological in nature and MTBI is neurological,” he said. “Many veterans in the healthcare system are dealing with MTBI, PTSD or both. Our emphasis today is to find the best treatments and measure the patient’s progress. Imaging has the potential to do that.”

Other co-authors are Jeffrey D. Stout, B.S., Richard R. Bucholz, M.D., Evan Schulze, B.A., Mark Colijn, M.S., and Jacob Bolzenius, M.A.

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MR-guided Ultrasound Offers Noninvasive Treatment for Breast Cancer

AT A GLANCE

- **MR-guided focused ultrasound (MRgFUS) ablation is a noninvasive breast cancer treatment technique.**
- **Post-surgical evaluation confirmed the absence of residual disease in the treatment area in 83 percent of patients.**
- **None of the patients in the study experienced significant complications.**

CHICAGO – A technique that uses focused ultrasound under magnetic resonance (MR) guidance to heat and destroy tumors may offer a safe and effective treatment for breast cancer, according to research being presented today at the annual meeting of the Radiological Society of North America (RSNA).

MR-guided focused ultrasound (MRgFUS) ablation is a noninvasive technique that requires no incision or puncture to perform. Instead, it uses the acoustic energy from high-intensity focused ultrasound to remove, or ablate, diseased tissue. Continuous MRI is used to locate the lesions and monitor the temperature change during the ablation process.

Primary advantages of MRgFUS over other breast cancer treatments are that it is a noninvasive, outpatient procedure offering a quick recovery time, and that it provides precise measurement of temperature changes during the procedure.

“In the treatment stage, we are able to precisely visualize where the energy is having an effect and to measure exactly the rise in temperature,” said Alessandro Napoli, M.D., Ph.D., assistant professor of radiology at Sapienza University in Rome. “Temperature monitoring is particularly important, since too low a temperature is ineffective and too high a temperature may be dangerous.”

Dr. Napoli and colleagues assessed the safety and efficacy of MRgFUS in 12 patients with invasive ductal breast cancer before surgical removal of the cancer and biopsy of the lymph nodes. They used 3T MRI to confirm the presence and treatable location of cancerous lesions. The patients then underwent single-session MRgFUS treatment. Researchers evaluated treatment efficacy through post-surgery pathology.

None of the patients experienced significant complications during or immediately after the procedure. In 10 of the 12 patients, MRI showed no enhancement in the treatment area after the

procedure. Post-surgery histological evaluation confirmed the absence of residual disease in the treatment area in those 10 patients.

“This procedure allows for safe ablation of breast cancer,” Dr. Napoli said. “At pathology, no significant viable tumor was found in the specimens from these 10 patients.”

In the other two cases, treatment failed due to transducer malfunction, and the pathologist observed residual tumor in the samples.

According to Dr. Napoli, MRI guidance is crucial for correct identification of lesions, treatment planning and real-time control during the procedure. Specifically, monitoring with MRI allows for efficient deposit of energy into the region of treatment at the correct range of between 60 degrees and 70 degrees Celsius (approximately 140 to 158 degrees Fahrenheit).

“This is carried out by a special sequence that is called MR thermometry,” Dr. Napoli said. “Only MRI presently has the ability to determine, in real time, fine temperature quantification.”

While the initial results are promising, Dr. Napoli said more research will be needed before the approach can be adopted as a stand-alone treatment for breast cancer.

Co-authors are Luisa Di Mare, M.D., Federica Pediconi, M.D., Michele Anzidei, M.D., Vincenzo Noce, M.D., and Carlo Catalano, M.D.

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Embolization Procedure Aids in Weight Loss

AT A GLANCE

- **Individuals who underwent embolization of the left gastric artery for gastrointestinal bleeding experienced a 7.9 percent decrease in body weight three months after the procedure.**
- **The left gastric artery supplies blood to the part of the stomach where the appetite-stimulating hormone ghrelin is predominantly produced.**
- **Left gastric artery embolization is low risk when compared to more invasive weight loss interventions, such as gastric bypass and laparoscopic approaches.**

CHICAGO – A new study reports that individuals who underwent embolization of the left gastric artery for gastrointestinal bleeding experienced a 7.9 percent decrease in body weight three months after the procedure. Results of the study, which offer a potential new avenue for obesity research, will be presented next week at the annual meeting of the Radiological Society of North America (RSNA).

Transarterial embolization is a common interventional procedure used to treat a variety of medical conditions. In the image-guided procedure, an embolic, or obstructive, agent is inserted through a catheter and placed inside an artery to prevent blood flow in an artery or to a specific area of the body. Types of embolic agents include beads, coils and gel foam.

In the retrospective study conducted at Massachusetts General Hospital in Boston, researchers reviewed the records of patients who underwent transarterial embolization for upper gastrointestinal (GI) bleeding. The study group included 14 patients who underwent embolization of the left gastric artery, which supplies blood to the part of the stomach where the hormone ghrelin is predominantly produced.

“Ghrelin is the only hormone known to stimulate the appetite, so it is an intriguing potential target for combating obesity,” said senior researcher Rahmi Oklu, M.D., Ph.D., assistant professor of radiology at Harvard Medical School. “Animal studies have shown that when this artery is blocked, blood levels of ghrelin decrease and weight loss occurs.”

The study also included a review of the records of 18 age-matched control patients who were treated for upper GI bleeding with transarterial embolization of a different upper gastrointestinal

artery. The study group included eight men and six women with a median age of 66.1 years; the control group included eight men and 10 women with a median age of 63.5 years.

The researchers found that patients who underwent left gastric artery embolization lost an average of 7.9 percent of their body weight within three months of the procedure. Weight loss within the control group was 1.2 percent during the same time frame.

“Embolizing the left gastric artery may be a potential bariatric treatment for weight loss and an alternative to other invasive procedures,” Dr. Oklu said. “This is an important data point in the development of a new clinical tool for the treatment of obesity.”

Dr. Oklu pointed out that left gastric artery embolization performed by an interventional radiologist is low risk when compared to more invasive weight loss interventions, such as gastric bypass and laparoscopic approaches.

“The effect of left gastric artery embolization will need to be studied in larger populations and eventually in prospective trials,” he added.

The Centers for Disease Control and Prevention report that 69.2 percent of U.S. adults over the age of 20 are overweight, and 35.9 percent of adults over age 20 are obese.

Co-authors are Andrew J. Gunn, M.D. (lead author), and Elizabeth J. Hamilton, B.S.

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Breast Cancer Risk Related to Changes in Breast Density as Women Age

AT A GLANCE

- **The rate at which breast density changes in some women as they age may affect their breast cancer risk.**
- **Researchers compared breast density and cancer risk between younger and older women and analyzed how the risk relates to changes in breast density over time.**
- **Breast density, as determined by mammography, is known to be a strong and independent risk factor for breast cancer.**

CHICAGO – Automated breast density measurement is predictive of breast cancer risk in younger women, and that risk may be related to the rate at which breast density changes in some women as they age, according to research being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Breast density, as determined by mammography, is already known to be a strong and independent risk factor for breast cancer. The American Cancer Society (ACS) considers women with extremely dense breasts to be at moderately increased risk of cancer and recommends they talk with their doctors about adding magnetic resonance imaging (MRI) screening to their yearly mammograms.

“Women under age 50 are most at risk from density-associated breast cancer, and breast cancer in younger women is frequently of a more aggressive type, with larger tumors and a higher risk of recurrence,” said the study’s senior author, Nicholas Perry, M.B.B.S., FRCS, FRCR, director at the London Breast Institute in London, U.K.

For the new study, Dr. Perry and colleagues compared breast density and cancer risk between younger and older women and analyzed how the risk relates to changes in breast density over time. The study group included 282 breast cancer cases and 317 healthy control participants who underwent full-field digital mammography, with breast density measured separately using an automated volumetric system.

“In general, we refer to breast density as being determined by mammographic appearance, and that has, by and large, in the past been done by visual estimation by the radiologist—in other words, subjective and qualitative,” Dr. Perry said. “The automated system we used in the study is an

algorithm that can be automatically and easily applied to a digital mammogram, which allows an objective and, therefore, quantitative density measurement that is reproducible.”

Breast cancer patients showed higher mammographic density than healthy participants up to the age of 50. The healthy controls demonstrated a significant decline in density with age following a linear pattern, while there was considerably more variability in density regression among the breast cancer patients.

“The results are interesting, because there would appear to be some form of different biological density mechanism for normal breasts compared to breasts with cancer, and this appears to be most obvious for younger women,” Dr. Perry said. “This is not likely to diminish the current ACS guidelines in any way, but it might add a new facet regarding the possibility of an early mammogram to establish an obvious risk factor, which may then lead to enhanced screening for those women with the densest breasts.”

For instance, some women might undergo a modified exposure exam at age 35 to establish breast density levels, Dr. Perry noted. Those with denser breast tissue could then be followed more closely with mammography and additional imaging like MRI or ultrasound for earlier cancer detection and treatment.

“It has been estimated that about 40 percent of life years lost to breast cancer are from women under 50 diagnosed outside of screening programs,” Dr. Perry said. “In my practice, which is largely composed of urban professional women, 40 percent of cancers year to year are diagnosed in women under 50, and 10 percent in women younger than 40.”

Co-authors are Katja Pinker-Domenig, M.D., Kefah Mokbel, M.B.B.S., FRCS, Sue E. Milner, B.Sc., and Stephen W. Duffy, M.Sc.

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Novel Rehabilitation Device Improves Motor Skills after Stroke

AT A GLANCE

- **Stroke patients are benefiting from a novel rehabilitation device that converts their thoughts to electrical impulses to move their upper extremities.**
- **Even patients who had been diagnosed with severe strokes showed improvement in carrying out activities of daily living following rehabilitation.**
- **Each year, a new or recurrent stroke occurs in nearly 800,000 people in the U.S.**

CHICAGO – Using a novel stroke rehabilitation device that converts an individual’s thoughts to electrical impulses to move upper extremities, stroke patients reported improvements in their motor function and ability to perform activities of daily living. Results of the study were presented today at the annual meeting of the Radiological Society of North America (RSNA).

“Each year, nearly 800,000 people suffer a new or recurrent stroke in the United States, and 50 percent of those have some degree of upper extremity disability,” said Vivek Prabhakaran, M.D., Ph.D., director of functional

neuroimaging in radiology at the University of Wisconsin-Madison. “Rehabilitation sessions with our device allow patients to achieve an additional level of recovery and a higher quality of life.”

Dr. Prabhakaran, along with co-principal investigator Justin Williams, Ph.D., and a multidisciplinary team, built the new rehabilitation device by pairing a functional electrical stimulation (FES) system, which is currently used to help stroke patients recover limb function, and a brain control interface (BCI), which provides a direct communication pathway between the brain and this peripheral stimulation device.

In an FES system, electrical currents are used to activate nerves in paralyzed extremities. Using a computer and an electrode cap placed on the head, the new BCI-FES device (called the Closed-Loop Neural Activity-Triggered Stroke Rehabilitation Device) interprets electrical impulses from the brain and transmits the information to the FES.

“FES is a passive technique in that the electrical impulses move the patients’ extremities for them,” Dr. Prabhakaran said. “When a patient using our device is asked to imagine or attempt to move his or her hand, the BCI translates that brain activity to a signal that triggers the FES. Our system adds an active component to the rehabilitation by linking brain activity to the peripheral stimulation device, which gives the patients direct control over their movement.”

The Wisconsin team conducted a small clinical trial of their rehabilitation device, enlisting eight patients with one hand affected by stroke. The patients were also able to serve as a control group by using their normal, unaffected hand. Patients in the study represented a wide range of stroke severity and amount of time elapsed since the stroke occurred. Despite having received standard rehabilitative care, the patients had varying degrees of residual motor deficits in their upper extremities. Each underwent nine to 15 rehabilitation sessions of two to three hours with the new device over a period of three to six weeks.

The patients also underwent functional magnetic resonance imaging (fMRI) and diffusion tensor imaging (DTI) before, at the mid-point of, at the end of, and one month following the rehabilitation period. fMRI is able to show which areas of the brain are activated while the patient performs a task, and DTI reveals the integrity of fibers within the white matter that connects the brain's functional areas.

Patients who suffered a stroke of moderate severity realized the greatest improvements to motor function following the rehabilitation sessions. Patients diagnosed with mild and severe strokes reported improved ability to complete activities of daily living following rehabilitation.

Dr. Prabhakaran said the results captured throughout the rehabilitation process—specifically the ratio of hemispheric involvement of motor areas—related well to the behavioral changes observed in patients. A comparison of pre-rehabilitation and post-rehabilitation fMRI results revealed reorganization in the regions of the brain responsible for motor function. DTI results over the course of the rehabilitation period revealed a gradual strengthening of the integrity of the fiber tracts.

“Our hope is that this device not only shortens rehabilitation time for stroke patients, but also that it brings a higher level of recovery than is achievable with the current standard of care,” Dr. Prabhakaran said. “We believe brain imaging will be helpful in both planning and tracking a stroke patient's therapy, as well as learning more about neuroplastic changes during recovery.”

Other co-authors are Dorothy Farrar-Edwards, Ph.D., Justin Sattin, M.D., Mitch Tyler, Ph.D., Veena A. Nair, Ph.D., Svyatoslav Vergun, B.S., Leo Walton, B.S., Jie Song, M.S., and Brittany Young, B.A., B.S.

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Blood Vessels Reorganize after Face Transplantation Surgery

AT A GLANCE

- **Research shows that blood vessels in recipients of full face transplants reorganize themselves.**
- **Researchers used 320-detector row dynamic CT angiography to study the facial allografts of patients one year after successful transplantation.**
- **The development of new blood vessel networks in transplanted tissue is critical to the success of face transplant surgery.**

CHICAGO – For the first time, researchers have found that the blood vessels in face transplant recipients reorganize themselves, leading to an understanding of the biologic changes that happen after full face transplantation. The results of this study were presented today at the annual meeting of the Radiological Society of North America (RSNA).

Face transplantation is a recent development in reconstructive surgery for patients who have lost some or all of their face from injury or disease. The first full face transplantation in the United States was carried out at Brigham and Women’s Hospital in Boston in 2011. Hospital specialists subsequently performed full face transplantations on three additional patients.

As part of the procedure, surgeons connect the patient’s major arteries and veins to those from a donor face, or facial allograft, to ensure healthy circulation in the transplanted tissue. Because the technology is new, not much is known about the vascular changes that help blood penetrate, or perfuse, into the transplanted tissue. The development of new blood vessel networks in transplanted tissue is critical to the success of face transplant surgery.

“All three patients included in this study at Brigham and Women’s maintain excellent perfusion, or blood flow, the key element of viability of the facial tissues and the restoration of form and function to those individuals who otherwise had no face,” said study co-author Frank J. Rybicki, M.D., Ph.D., FAHA, FACR, director of the hospital’s Applied Imaging Science Laboratory. “We assumed that the arterial blood supply and venous blood return was simply from the connections of the arteries and the veins at the time of the surgery.”

To learn more, Dr. Rybicki and Kanako K. Kumamaru, M.D., Ph.D., research fellow at Brigham and Women’s Applied Imaging Science Laboratory, used 320-detector row dynamic computed tomography angiography (CTA) to study the facial allografts of the three patients one year after

successful transplantation. The CTA technology offers imaging over 16 centimeters of coverage, enabling the researchers to view collateralization, a process in which the body stimulates existing blood vessels to elongate, widen and form new connections. Collateralization often results from anastomoses, or branches formed between adjacent blood vessels.

“The key finding of this study is that, after full face transplantation, there is a consistent, extensive vascular reorganization that works in concert with the larger vessels that are connected at the time of surgery,” Dr. Kumamaru said.

Results showed that the new blood vessel networks course posteriorly, or toward the ears and even farther behind the head, in addition to the large arteries and veins that course anteriorly in the face, or close to the jaw.

“We have found that since the vessels more commonly associated with the back of the head are critical to maintain the perfusion via vascular reorganization, it is essential to visualize these vessels and determine that they are normal pre-operatively,” Dr. Kumamaru said. “Patients under consideration for face transplantation have universally had some catastrophic defect or injury.”

The authors note that the findings could help improve surgical planning and assessment of potential complications in face transplant patients. For instance, previous literature recommends the joining of multiple arteries and veins to ensure adequate blood flow in the facial allograft. However, performing these multiple connections causes longer operation time compared with a single anastomosis.

“Our findings support the simplified anastomosis for full face transplant procedure that, in turn, can potentially shorten the operative time and reduce procedure-associated complications,” Dr. Rybicki said.

Co-authors are Elizabeth George, M.B.B.S., Bohdan Pomahac, M.D., Michael L. Steigner, M.D., Geoffroy C. Sisk, M.D., Kurt Schultz, R.T., Dimitris Mitsouras, Ph.D., David S. Enterline, M.D., and Ericka M. Bueno, Ph.D.

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Mammography Screening Intervals May Affect Breast Cancer Prognosis

AT A GLANCE

- **Patients who had screening mammograms more often—less than 1.5 years between exams—had a significantly lower rate of cancer that had spread to the lymph nodes.**
- **The study included 332 women with breast cancer identified by screening mammography between 2007 and 2010.**
- **In 2009, the USPSTF recommended biennial screening for women between the ages of 50 and 74.**

CHICAGO – In a study of screening mammography-detected breast cancers, patients who had more frequent screening mammography had a significantly lower rate of lymph node positivity—or cancer cells in the lymph nodes—as compared to women who went longer intervals between screening mammography exams. Results of the study were presented today at the annual meeting of the Radiological Society of North America (RSNA).

In its earliest stages, breast cancer is confined to the breast and can be treated by surgically removing the cancer cells. As the disease progresses, breast cancer cells may spread to the lymph nodes and then to other areas of the body.

“On its pathway to other places in the body, the first place breast cancer typically drains into before metastasizing is the lymph nodes,” said Lilian Wang, M.D., assistant professor of radiology at Northwestern University/Feinberg School of Medicine in Chicago, Ill. “When breast cancer has spread into the lymph nodes, the patient is often treated both locally and systemically, with either hormone therapy, chemotherapy, trastuzumab or some combination of these therapies.”

Historically, healthcare organizations, such as RSNA and the American Cancer Society (ACS), have recommended annual screening with mammography for women beginning at age 40. However, in 2009, the United States Preventive Services Task Force (USPSTF) announced a controversial new recommendation for biennial screening for women between the ages of 50 and 74.

“Our study looks at what would happen if the revised guidelines issued by USPSTF were followed by women,” Dr. Wang said.

The retrospective study, conducted at Northwestern Memorial Hospital, included 332 women with breast cancer identified by screening mammography between 2007 and 2010. The women were divided into one of three groups, based on the length of time between their screening mammography exams: less than 1.5 years, 1.5 to three years and more than three years. There were 207, 73 and 52 patients in each category, respectively.

Controlling for age, breast density, high-risk status and a family history of breast cancer, the researchers determined that women in the less than 1.5-year interval group had the lowest lymph node positivity rate at 8.7 percent. The rate of lymph node involvement was significantly higher in the 1.5- to three-year and over three-year interval groups at 20.5 percent and 15.4 percent, respectively.

“Our study shows that screening mammography performed at an interval of less than 1.5 years reduces the rate of lymph node positivity, thereby improving patient prognosis,” Dr. Wang said. “We should be following the guidelines of the American Cancer Society and other organizations, recommending that women undergo annual screening mammography beginning at age 40.”

Co-authors are Ellen B. Mendelson, M.D., Paula M. Grabler, M.D., Riti Mahadevia, B.A., and Laura Billadello, M.D.

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