

Association of Childhood Obesity with the Central Nervous System (CNS): Study of Diffuse Tensor Imaging (DTI)

Thursday 10:40-10:50 AM | SSQ17-02 | Room: S103AB

PURPOSE

The aim of this work is to investigate the influence of childhood obesity on changes in anatomy and cerebral connectivity, using the DTI by Magnetic Resonance Imaging (MRI). The hypothesis is that the brain is an organ also affected by high adiposity, particularly the hypothalamus, which is a complex region involved in the regulation of appetite and hormonal homeostasis.

METHOD AND MATERIALS

The images were obtained on Achieva 3T Phillips Magnetic Resonance. The sample for statistical analysis consisted of 120 subjects: 59 obese adolescents and 61 healthy adolescents, aged 11 years to 18 years, and matched regarding gender, age, and schooling. The images were processed with the FSL-Tbss (Tract Based Spatial Statistics) program and analyzed statistically by the same program with Randomize.

RESULTS

Statistical analysis showed decrease in the values of Fractional Anisotropy (FA) of obese pediatric patients compared with healthy controls in amygdala, hippocampus, thalamus, cingulate gyrus, fornix, insula, putamen, orbital gyrus and bilateral hypothalamus. There was no region of higher FA in obese patients in relation to the control group.

CONCLUSION

The data reveal a pattern of involvement in important regions in the control of appetite and emotions. Limbic structures, such as amygdala, hippocampus, thalamus, cingulate gyrus, fornix and insula are altered. Important regions related to impulse control, reward and pleasure in eating (putamen and orbital gyrus) and autonomic appetite control (bilateral hypothalamus) were also shown to have decreased FA.

CLINICAL RELEVANCE/APPLICATION

Childhood obesity is a subject of high clinical importance, and presents data of ascent from 10 to 40% of the last 10 years in most countries. Previous studies have pointed to obesity as a risk factor for neurodegenerative disorders through DTI tractography. In this way, we investigated previous or early cerebral changes in obesity.

Biennial versus Annual Screening Mammography: What Do Women Prefer?

Monday 12:15-12:45 PM | BR222-SD-MOA2 | BR Community, Learning Center Station #2

PURPOSE

To determine whether women prefer annual vs. biennial screening and investigate whether or not reported “harms” of mammography influence this preference.

METHOD AND MATERIALS

This study was approved by the Institutional Review Board (IRB). From December 2016 to February 2017, patients presenting for a screening or diagnostic mammogram were recruited at the time of their scheduled mammogram and asked to complete an anonymous voluntary one-time survey. The survey queried patients about whether an abnormal mammogram or breast biopsy causes emotional harm, whether a biennial screening mammogram is associated with less or more anxiety and whether women prefer to have a screening mammogram every other year instead of every year. Additional variables such as patient’s age and race, personal or family history of breast cancer, prior breast biopsy, prior abnormal mammogram, and underlying anxiety disorder were also included. The first 20 collected surveys were used to pilot the study to assure adequacy of the questionnaire. Subsequently, an additional 711 surveys were collected and statistical analysis were performed using an Independent T-test and Fishers exact test

RESULTS

71% of those surveyed preferred annual instead of biennial screening mammography (95% confidence interval [CI]= .68-.75). Participants overwhelmingly preferred annual screening despite how they answered the additional survey questions. A family history of breast cancer (risk difference [RD]= -0.11; P=0.002) and a prior breast biopsy (RD -0.09; P=0.01) were the only two variables to have an additional positive influence on annual screening mammogram preference. Only 17% of participants felt having biennial screening would cause less anxiety. Of the patients who reported a prior abnormal mammogram, 13% believe biennial screening would cause less anxiety (P=0.0001).

CONCLUSION

Despite the “harm” that an abnormal mammogram or breast biopsy may cause, women believe that a biennial screening mammogram is associated with more anxiety and therefore, prefer annual screening mammography.

CLINICAL RELEVANCE/APPLICATION

The US Preventive Services Task Force (USPSTF) recommendation for screening mammography intervals is in part, based on the “harms” of mammography. Our study shows that women acknowledge these “harms” but prefer to be screened for breast cancer on a yearly basis.

Sex differences in body composition and association with cardiometabolic risk

Monday 11:40-11:50 AM | SSC09-08 | Room: E450B

PURPOSE

Body composition differs between men and women, with women having proportionally more fat and men more muscle mass. Fat distribution is an important determinant of cardiometabolic risk, with certain ectopic fat depots [visceral adipose tissue (VAT), intramyocellular (IMCL) and intrahepatic lipids (IHL)] being more detrimental than others [femorogluteal subcutaneous adipose tissue (SAT)]. We hypothesized that there are sex-differences in body composition and ectopic fat depots and that these are associated with a sex-specific cardiometabolic risk profile.

METHOD AND MATERIALS

Our study was IRB-approved and HIPAA compliant. Written informed consent was obtained. We recruited 200 young, non-diabetic, overweight and obese subjects who were otherwise healthy (109 women, 91 men, mean age: 37±10 years, mean BMI: 35.2±5.8 kg/m²). After an overnight fast, subjects underwent DXA and CT for body composition, 1H-MRS at 3T of soleus muscle for IMCL and right hepatic lobe for IHL quantification, serum glucose, insulin and lipids. Men and women were compared by ANOVA. Linear regression analyses between body composition measures and cardiometabolic risk markers were performed.

RESULTS

Women and men were of similar age and BMI ($p=0.4$). Women had higher %fat mass by DXA and lower lean mass vs men ($p<0.0001$). However, men had more VAT and VAT/abdominal SAT, muscle mass ($p<0.0001$), IMCL ($p=0.0008$) and IHL ($p=0.005$), while women had more femoral SAT ($p<0.0001$). Compared to women, men had higher measures of cardiometabolic risk, including serum triglycerides, apolipoprotein B, fasting insulin and HOMA-IR ($p\leq 0.005$). However, in women, VAT, IMCL, and IHL were strongly associated with these measures of cardiometabolic risk ($p\leq 0.004$), while in men these associations were weaker or non-significant.

CONCLUSION

Obese men have relatively higher VAT, IMCL, IHL, muscle and lean mass, while obese women have more %fat mass and femoral SAT. This female anthropometric phenotype is associated with a better cardiometabolic risk profile at a similar BMI compared to men. However, ectopic fat is more strongly associated with adverse cardiometabolic risk factors in women compared to men.

CLINICAL RELEVANCE/APPLICATION

The female pattern of fat distribution is associated with improved cardiometabolic risk compared to men at similar BMI, while ectopic fat in women portends greater metabolic risk.

Sarcopenic Obesity and cardiometabolic risk in young adults with obesity

Monday 11:50-12:00 PM | SSC09-09 | Room: E450B

PURPOSE

Sarcopenic obesity, reduced skeletal muscle mass in the setting of obesity, is an important risk factor for cardiometabolic disease in the elderly, but it is unknown whether relatively lower skeletal muscle mass for BMI in young adults, i.e. relative sarcopenia, contributes to cardiometabolic risk. We hypothesized that relative sarcopenia is associated with cardiometabolic risk markers in young adults with obesity.

METHOD AND MATERIALS

Our study was IRB-approved and HIPAA compliant. Written informed consent was obtained. We recruited 188 young overweight and obese subjects who were otherwise healthy, including without diabetes mellitus (100 women, 88 men, mean age: 36.8±9 years, mean BMI: 35.0±5.7 kg/m²). All subjects underwent DXA and CT for body composition, an oral glucose tolerance test (OGTT), fasting serum insulin, lipids and inflammatory markers. DXA appendicular lean mass (ALM)/BMI was used as a measure of relative sarcopenia and subjects were divided by the ALM/BMI median. Groups were compared by ANOVA.

RESULTS

Women with lower ALM/BMI (relative sarcopenia) had a higher mean 120-min glucose level ($p=0.02$) and higher glucose area under the curve on OGTT ($p=0.003$), lower HDL cholesterol ($p=0.02$), higher apolipoproteinB (ApoB) and ApoB/LDL ($p=0.02$), higher hsCRP ($p=0.005$) and fibrinogen ($p<0.0001$) and lower muscle attenuation, suggestive of fatty infiltration ($p=0.003$) compared to women with higher ALM/BMI, despite similar age ($p=0.7$) and weight ($p=0.5$). Men with lower ALM/BMI had higher mean insulin ($p=0.001$), HOMA-IR ($p=0.003$), hsCRP ($p=0.008$) and fibrinogen ($p=0.007$), and lower muscle attenuation ($p=0.006$) compared to men with higher ALM/BMI, despite similar age ($p=0.6$) and weight ($p=0.4$).

CONCLUSION

Relative sarcopenia (lower ALM/BMI) is associated with measures of cardiometabolic risk in young adults with obesity, and these effects are stronger in women than in men. Our study suggests that relative sarcopenia may be an under-appreciated mechanism linking obesity to cardiometabolic risk, and prospective studies are needed to determine whether relative sarcopenia predicts incident cardiometabolic disease over time.

CLINICAL RELEVANCE/APPLICATION

Relative sarcopenia may be an under-appreciated mechanism linking obesity to cardiometabolic risk in young adults with obesity, a high-risk group for developing cardiometabolic disease.

Hip Steroid/Anesthetic Injections: Is there an Increased Incidence of Hip Osteoarthritis Progression, Femoral Head Osteonecrosis and Collapse?

Wednesday 11:30-11:40 AM | SSK13-07 | Room: E353C

PURPOSE

To evaluate incidence of osteoarthritis progression, femoral head osteonecrosis and articular surface collapse in hip steroid/anesthetic injection patients.

METHOD AND MATERIALS

Our study was IRB-approved and HIPAA compliant. A total of 123 hip steroid/anesthetic (40 mg triamcinolone, 4 mL 0.5% preservative free ropivacaine) injections were performed from 01/2014 to 07/2015. Inclusion criterion was follow-up radiography of the native hip 3-9 months after the injection. Two musculoskeletal radiologists performed retrospective, blinded reviews of the pre- and post-injection radiography of hip injection patients (HIPs) and 2 demographic and follow-up duration matched control groups: 1, patients undergoing hip x-rays without injection; 2, glenohumeral joint injection patients. Groups were compared with Fisher exact test.

RESULTS

There were 102 HIPs (age 65 ± 13 (range 19-92) years; 62 F, 40 M; 41 L, 61 R), who were followed for 26 ± 10 (12-66) weeks. For Reader 1, 38/102 (37%) of HIPs had increased osteoarthritis after steroid injection, compared with 27/102 (26%) of hip controls and 14/44 (32%) of shoulder injection patients. For Reader 2, 42/102 (41%) of HIPs had increased osteoarthritis after steroid injection, compared with 20/102 (20%) of hip controls and 10/44 (23%) of shoulder injection patients. There was no significant difference between these groups ($P > 0.05$). For Reader 1, 24/102 (24%) of HIPs had new osteonecrosis and 15/102 (15%) had new collapse after the steroid injection, compared with 9/102 (9%) and 4/102 (4%) of hip controls and 2/44 (5%) and 1/44 (2%) of shoulder injection patients. There was significantly more osteonecrosis and collapse in HIPs, compared with hip controls ($P = 0.001$ and 0.01) and shoulder injection patients ($P = 0.005$ and 0.04). For Reader 2, 22/102 (22%) of HIPs had new osteonecrosis and 17/102 (17%) had new collapse after the steroid injection, compared with 9/102 (9%) and 4/102 (4%) of hip controls and 2/44 (5%) and 1/44 (2%) of shoulder injection patients. There was significantly more osteonecrosis and collapse in HIPs, compared with hip controls ($P = 0.01$ and 0.01) and shoulder injection patients ($P = 0.03$ and 0.005).

CONCLUSION

Hip injection patients have a greater incidence of osteonecrosis and collapse compared with hip controls and shoulder injection patients.

CLINICAL RELEVANCE/APPLICATION

Further evaluation of hip injectates and the injection population is warranted, given these findings.

MEG Measured Default Mode Network is Altered by History of Concussion in High School Football

Monday 3:40-3:50 PM | SSE19-05 | Room: N230

PURPOSE

The purpose of this study is to determine if history of previous concussion modulates connectivity changes in the magnetoencephalography (MEG) measured default mode network (DMN).

METHOD AND MATERIALS

Twenty players from a high school football team (mean age=16.9; right handed) were included in this study. Eight minutes of eyes-open, resting-state MEG data were acquired for each subject using a 275 channel CTF whole-head system, pre- and post-season. Structural anatomic MRI was acquired for co-registration with MEG. Using Brainstorm, MEG data were pre-processed and filtered to 1-100Hz. Eye blinks, and muscle artifacts were removed using independent component analysis. MEG data were projected into standard source space using the whitened and depth-weighted linear L2-minimum norm estimates algorithm (wMNE). A mean time series was extracted from eight regions of interest (ROIs) representing the DMN: inferior parietal L&R, medial orbitofrontal L&R, posterior cingulate L&R, superior frontal L&R. The correlation between all ROIs was computed. Each correlation was converted to z-scores, the average DMN correlation was computed, and the difference between pre- and post-season correlation was computed. The subjects were divided into two groups: those with a history of concussion (N=5) and those without a history of concussion (N=15). A two sample t-test was performed to estimate the difference in mean DMN correlation between the two groups.

RESULTS

Subjects with a history of concussion had significantly lower DMN correlations from pre-season to post-season ($p = 0.001$). The subjects with previous concussions had a negative change in correlation whereas subjects without a history of concussion had, on average, a positive change. No significant differences were found in age, BMI, or head impact exposure between the two groups. One data point was excluded based on outlier analysis.

CONCLUSION

Changes in the MEG measured DMN, over a season of football, may be dependent on the subject's history of concussion. fMRI literature has also demonstrated changes in the DMN are dependent on the history of concussion. Our previous work has shown that concussion history can modulate DMN connectivity changes associated with head impact exposure.

CLINICAL RELEVANCE/APPLICATION

MEG has shown promise as a sensitive modality for concussion diagnosis. Prior concussion history should be considered when performing analyses of MEG data involving repeated head impacts.

Radiology in the Midst of the Opioid Epidemic: 12-year Analysis of Imaging Findings, Mortality and Opioid Prescription History among Patients with Intravenous Substance Use Disorders (IV-SUDs) Presenting to Emergency Radiology

Thursday 11:50-12:00 PM | SSQ06-09 | Room: S405AB

PURPOSE

To assess the prevalence and type of IV-SUDs imaging complications, mortality rate, and history of opioid prescriptions (OP) and in patients presenting to Emergency Radiology (ER).

METHOD AND MATERIALS

HIPAA compliant-IRB approved retrospective study of 1031 patients who presented to ER (2005 to 2016) to assess IV-SUDs complications. Demographics, clinical symptoms, imaging diagnosis, history of OP, and dates of death were recorded. Exams were categorized by imaging diagnosis, modality and specialty. Analyses for significant differences were done.

RESULTS

In 1031 patients (65% men; mean age 36 yrs; 78% white; 95% English speakers), 1673 exams (779 X-rays, 544 CT, 292 MRI and 58 US) were performed (1-13 exams per patient, mean 1), accounting for 0.2% (1673/854299) of all ER studies in the same period. 52% of patients had 1 or more studies with IV-SUDs complications. The rates of positive imaging per imaging specialty were: GI 77% (113/146), MSK 52% (419/802), Vascular 48% (77/162), Neuro 47% (97/206), and chest 25% (90/356). Most frequent clinical symptoms were local complications of injections (27%, 450/1673), respiratory (15%, 251/1673) and back pain (13.4%, 224/1673). History of OP before the first imaging was present in 30% (310/1031) of cases (mean 10 prescriptions per patient); significantly more often in women (37%, 128/348), than men (27%, 182/673, $p=0.008$). Mean time from OP to first imaging was 51 months (SD 39); significantly shorter in men (45 months) than women (51 months, $p=0.01$). Overall death was recorded in 11.7% (121/1031) of patients; significantly higher in patients with positive imaging diagnosis of IV-SUDs complications (14%, 73/534) than in those without (10%, 48/449, $p=0.04$). 5-yr mortality rates were: 7% (73/1031) overall; higher in patients with prior opioid prescription (9%, 29/310) than in those without (6%, 44/721, $p=0.06$); higher in patient with imaging complications (6%, 33/534) than in those without (4%, 21/427, $p=0.2$).

CONCLUSION

There is a high prevalence of multisystem IV-SUDs imaging complications among patients presenting to the ER. Patients with positive imaging findings and prior OP have a higher overall mortality rate compared to patients with negative imaging.

CLINICAL RELEVANCE/APPLICATION

Understanding factors associated with IV-SUDs imaging complications is fundamental to designing responsive patient care models that can better support the health and survival of this vulnerable population.

Intimate Partner Violence and Sexual Assault: Clinical and Radiologic Findings

Monday 10:00-10:10 AM | RC208-06 | Room: E450A

PURPOSE

Intimate partner violence (IPV) and sexual assault (SA) are under-recognized entities in Emergency Radiology even though 1 in 4 women in the US experiences physical abuse or sexual assault by their intimate partner. We aim to study the demographics, clinical presentation, and radiologic findings in these patients.

METHOD AND MATERIALS

Patients referred to the domestic abuse (n=87) and sexual assault programs (n=35) from January to October 2016 were identified. Demographics, clinical presentation, and radiologic studies performed within 5 years of presentation were reviewed from the electronic medical record.

RESULTS

Majority of the IPV victims were female (95%) and African-American (40%), with a mean age of 34.7 (± 12.0) years. Almost all (97.7%) patients presented to the ED, presenting symptom was unrelated to IPV in 44.8%, and 83% endorsed prior history of violence. A total of 665 radiology exams were performed, for a median number of 4 studies per patient (IQR: 0-10; maximum=65). The most commonly performed exam was chest radiograph, followed by obstetric ultrasound (US), and musculoskeletal (MSK) radiographs. The common traumatic injuries were extremity fractures (n=6), nasal bone fractures (acute/chronic, n=4), orbital fractures (n=2), soft tissue injury (hematoma/laceration, n=7), and spinal fracture/compression (n=3). Other findings potentially related to violence were subchorionic hematoma (n=5), pregnancy failure (n=6), and intrauterine growth retardation (n=2). SA victims were younger (27.3 ± 7.7 years), majority female (91%), and African-American (46%). A total of 109 radiology exams were performed, for a median number of 4 studies per patient (IQR: 1.75-12.25; maximum=25). The most commonly performed exam was chest radiograph, followed by CT head, pelvic US and MSK radiographs. There were fewer traumatic injuries in this population; orbital wall deformity (n=1), soft tissue swelling (n=2), and spinal compression fracture (n=1).

CONCLUSION

A wide range of imaging studies are performed on IPV patients and radiologists can potentially play a role in early detection by identifying patterns of injury.

CLINICAL RELEVANCE/APPLICATION

Intimate partner violence is challenging to identify due to variable presentation and often coexisting psychiatric history; identification of radiologic patterns of injury may enable early establishment of care.

Are different weight loss regimens in obese and overweight individuals associated with different degrees of cartilage degeneration over 96 months? Data from the Osteoarthritis Initiative

Tuesday 3:20-3:30 PM | SSJ16-03 | Room: E451A

PURPOSE

To investigate MR-based cartilage biochemical degeneration and morphologic joint abnormalities over 96 months in overweight and obese subjects with stable weight and weight loss and to assess how these changes are affected by different weight loss regimens.

METHOD AND MATERIALS

Subjects with a BMI > 25 kg/m² from the Osteoarthritis Initiative (n=760; age 62.6±9.0y; 465 females) with risk factors for or radiographic mild to moderate osteoarthritis were included. Subjects losing weight (>5% of baseline BMI; N=380) were frequency matched to controls with stable weight (N=380) and categorized into groups regarding the weight loss method (diet and exercise, diet only, exercise only). 3T MRI of the right knee was performed at baseline, 48- and 96-months. T2 relaxation time changes of cartilage composition, including laminar and texture analysis as well as morphological knee abnormalities, assessed with Whole-Organ-Magnetic-Resonance-Imaging-Scores (WORMS) were analyzed using mixed random effects models to calculate associations between amount of weight loss and regimen.

RESULTS

Progression of cartilage WORMS was significantly lower in the weight loss group compared to controls (P<0.001) over 96 months. Subjects with weight loss showed significantly less T2-value increase in the bone layer of all compartments (P<0.03, for each) compared to the controls with stable weight, suggesting less cartilage degeneration over 96 months in the subjects with weight loss compared to their controls. Rates of increase in cartilage T2 averaged over all compartments were lowest in the diet and diet and exercise groups compared to the stable weight group (P=0.042 and P=0.003, respectively). Weight loss through exercise alone showed no significant difference in change of T2 over 96 months compared to subjects with stable weight (P=0.56).

CONCLUSION

Results suggest that cartilage degeneration is slowed through weight loss in obese and overweight subjects over 96-months. This protective effect was, however, only found in subjects losing weight through diet and combined exercise and diet programs.

CLINICAL RELEVANCE/APPLICATION

MR-based knee cartilage T2 measurements and semiquantitative grading allow monitoring of the protective effect of weight loss on joint health and are useful to determine which weight loss regimen is most beneficial in overweight and obese patients.

Surgical Reconstruction of Ossicular Chain Defect with Custom 3D Printed Ossicular Prosthesis

Friday 10:30-10:40 AM | SST08-01 | Room: E353A

PURPOSE

Conductive hearing loss due to ossicular abnormalities occurs from many causes, including trauma, infection, cholesteatoma, surgery and congenital anomalies. Surgical reconstruction of the ossicular chain is a well-established procedure for repair of ossicular defects, but is still plagued by high failure rates. Underlying disease and proper sizing of prostheses are two challenges that lead to component failure. Three-dimensional (3D) printing has been used successfully to solve a number of medical prosthesis problems. Custom 3D printing an individualized ossicular prosthesis would be a potential solution for the wide range of anatomic variation encountered in the pathological middle ear, and could decrease the rate of post-operative prosthesis displacement by increasing the likelihood of a proper fit, in addition to decreasing surgical time.

METHOD AND MATERIALS

The incus was removed from three formalin-fixed cadaveric human temporal bones with no macro- or microscopic evidence of pathology. Imaging of the cadaveric bone was obtained using a standard temporal bone CT protocol. A custom prosthesis for each cadaveric human temporal bone was designed using the Mimics Innovation Suite software (Materialise, Belgium) and fabricated on a Form2 3D printer (FormLabs, Somerville, Massachusetts). Four surgeons then performed insertion of each prosthesis into each middle ear, blinded to the bone from and for which each was designed. The surgeons were asked to match each prosthesis to its correct parent bone.

RESULTS

Each prosthesis had unique measurements. Each of the four surgeons was able to correctly match the prosthesis model to its intended temporal bone. The chances of this occurring randomly are 1:1296.

CONCLUSION

A custom 3D printed ossicular prosthesis is a viable solution for conductive hearing loss due to ossicular chain defects. Commercially available CT scanners can detect significant anatomic differences in normal human middle ear ossicles. These differences can be accurately represented with current 3D printing technology and, more significantly, surgeons can detect these differences.

CLINICAL RELEVANCE/APPLICATION

This process overcomes a common technical challenge of properly sizing the prosthesis, as each model is custom made for an exact fit which should lead to an improved result and decreased operative time.

Aortic Dimensions and Subclinical Atherosclerosis in Former National Football League Athletes

Wednesday 11:40-11:50 AM | SSK04-08 | Room: S504AB

PURPOSE

To evaluate whether past participation in the National Football League (NFL) is associated with increased prevalence of ascending aortic dilation and coronary artery calcium (CAC) on cardiac CT.

METHOD AND MATERIALS

This is a retrospective, cross-sectional study of 206 former National Football League (NFL) athletes compared with 759 matched male subjects from the XXX Heart Study (XHS) older than 40 years old with body mass index ≥ 20 kg/m². Mid-ascending aortic dimensions were obtained from non-contrast, multidetector cardiac-gated CT scans performed as part of a screening protocol (NFL) or as part of the XHS. CAC scores were obtained using the Agatston method. Multivariate logistic regression was performed to evaluate predictors of aortic size > 4.0 cm, CAC >0 , and CAC >100 in each cohort.

RESULTS

Compared to the control group, former NFL athletes had significantly larger ascending aortic diameters (3.8 ± 0.5 vs. 3.4 ± 0.4 cm; $p < 0.0001$). A significantly higher proportion of former NFL players had an aorta of > 4.0 cm (29.6% versus 8.6%, $p < 0.0001$). After adjusting for age, race, body surface area, systolic blood pressure, history of hypertension, current smoking, diabetes, and lipid profile the former NFL players still had significantly larger ascending aortas ($p < 0.0001$). Former NFL players were twice as likely to have an aorta > 4.0 cm after adjusting for the same parameters. CAC scores were similar in both groups as was the distribution across CAC score categories (CAC=0, 1-100, and >100).

CONCLUSION

While CAC scores are similar between former NFL athletes and controls, ascending aortic dimensions are significantly larger in former NFL athletes even after accounting for their size, age and cardiac risk factors. Whether this translates to an increased risk is unknown and requires further evaluation.

CLINICAL RELEVANCE/APPLICATION

Past exposure to the hemodynamic effects of repetitive strenuous exercise among elite athletes may have lasting effects on aortic dimensions.

Assessment of the Neurologic Effects of Intracranial Gadolinium Deposition Using a Large Population Based Cohort

Wednesday 3:00-3:10 PM | SSM16-01 | Room: N226

PURPOSE

The neurotoxic potential of intracranial gadolinium (Gd) deposition following intravenous administration of gadolinium based contrast agents (GBCAs) is undefined. In the current study, we used the world's largest prospective population-based cohort on aging to study the effects of Gd exposure on neurologic and neurocognitive function.

METHOD AND MATERIALS

The Mayo Clinic Study of Aging (MCSA) cohort was enumerated from the Rochester Epidemiology Project in 2004 to study the incidence and natural history of cognitive impairment and dementia. All participants underwent extensive longitudinal clinical (neurologic evaluation, neuropsychological testing) assessment at baseline and 15-month follow-up intervals. Neurologic and neurocognitive scores were compared using standard multivariate methods between MCSA patients with no history of prior Gd exposure and those who underwent prior Gd-enhanced MRI. Progression from normal cognitive status to mild-cognitive impairment and dementia was assessed using multistate Markov model analysis.

RESULTS

Among 4261 cognitively normal study participants aged 50-90 (mean age (SD): 71.9 yrs (10.7), mean study participation (SD): 3.7 yrs (3.0)), 1092 (25.6%) received one or more GBCA doses (median: 2 doses, range: 1-28 doses) unrelated to their participation in the MCSA. Median time since first Gd exposure was 5.6 years (IQR=2.2-9.3 years). After adjusting for age, sex, education level, baseline neurocognitive performance, Charlson comorbidity index, and ApoE4 status, GBCA exposure was not a significant predictor of cognitive decline (changes in clinical dementia rating ($p=.48$), Blessed dementia scale ($p=.68$), or mental status exam score ($p=.55$)), diminished neuropsychological performance ($p=.13$), or diminished motor performance (Unified Parkinson's Disease Rating Scale ($p=.43$)). No dose-related effects were observed among these metrics ($p=.89-.20$). Finally, Gd exposure was not an independent risk factor in the rate of cognitive decline from normal cognitive status to dementia in this cohort ($p=.91$).

CONCLUSION

GBCA administration was not associated with worse overall neurologic or neurocognitive performance nor does it significantly affect the natural progression of cognitive decline in a large population-based cohort.

CLINICAL RELEVANCE/APPLICATION

Despite evidence of Gd accumulation following intravenous GBCA administration, Gd exposure is not associated with adverse neurologic outcomes.

Cerebral Sodium (²³Na) Magnetic Resonance Imaging in Patients with Migraine vs. Healthy Controls

Tuesday 10:50-11:00 AM | SSG11-03 | Room: N226

PURPOSE

Evaluation of ²³Na concentrations in patients with clinically manifest migraine vs. healthy controls.

METHOD AND MATERIALS

In this prospective, IRB-approved study we recruited 12 patients (all female; mean age 34±11 years) who have been clinically evaluated for migraine and who have filled out a questionnaire regarding onset of disease, length, intensity (scale 1-10) and frequency of attacks and accompanying aura, as well as 12 healthy controls (all female; mean age 34±11 years). Both groups underwent a cerebral ²³Na-magnetic resonance imaging examination at 3.0T (TimTrio, Siemens Healthcare Sector). For each scan a non-contrast enhanced T1w MP-RAGE sequence for anatomical referencing and a 3D-density-adapted, radial gradient echo (GRE-) sequence for ²³Na-imaging were acquired using a double-tuned (¹H/²³Na), dedicated head-coil. ²³Na-sequences were reconstructed according to the MP-RAGE, allowing direct cross-referencing of regions-of-interest (ROI). Circular ROIs were placed in predetermined anatomic regions: anterior and posterior cerebrospinal fluid (CSF), grey and white matter (GM/WM), brain stem and cerebellum. External ²³Na reference phantoms were used to calculate the ²³Na tissue concentrations. ²³Na concentrations of migraine patients and healthy controls were compared and statistically analyzed by Wilcoxon rank sum test.

RESULTS

Overall ²³Na concentrations (in millimoles per liter) in the anterior CSF region of patients with manifest migraine were significantly higher with 79±7 vs. 69±4 in healthy controls (p=0.0001) (see figure 1). Similar findings were found for the posterior CSF region with ²³Na concentrations of 85±6 in migraine patients vs. 63±8 in healthy controls (p=0.0013). No statistical difference was found for ²³Na concentrations in the grey and white matter, brain stem and cerebellum.

CONCLUSION

Cerebral ²³Na concentrations in CSF of migraine patients are significantly higher than in healthy controls.

CLINICAL RELEVANCE/APPLICATION

Cerebral ²³Na MRI may be a potential imaging tool for the diagnosis of migraine.

Intra-Default Mode Network Connectivity Changes from a Single Season of Youth Football Distinguish Levels of Head Impact Exposure

Monday 3:30-3:40 PM | SSE19-04 | Room: N230

PURPOSE

This purpose of this study is to determine whether intra-default mode network (DMN) connectivity changes occur from youth (ages 9-13) contact sports using a machine learning-based approach.

METHOD AND MATERIALS

In this IRB-approved study of youth football athletes, each player was instrumented with the HIT system to record head impact acceleration. The seasonal risk of concussion was calculated by converting each impact into a risk of concussion and summing to a value, the player's risk of concussion-weighted cumulative exposure (RWE). Players were dichotomized into highest and lowest 10% exposure groups (13/group). Players experiencing a concussion or with a history of concussion were excluded. 13 non-contact sport controls were used as a third group. A pre and post-season 6 minute rs-fMRI was performed in all players and controls at 3-month scan interval. The fMRI data was preprocessed for motion correction, spatial smoothing and normalization. Resting-state network (RSN) sub-components, including DMN sub-components, were extracted using a higher order (60 component) group independent-components analysis (ICA). 8 DMN sub-components were identified and back-reconstructed to form individual subject's DMN sub-components pre- and post-season. Connectivity was computed using Pearson's correlation between sub-component mean time courses. The post minus pre-season connectivity changes formed our features. Five machine learning classification algorithms were evaluated to predict whether a player was a non-contact, low, or high impact exposure player.

RESULTS

Ten-fold cross validation results demonstrated for a Linear SVM classifier accuracy (82%) discriminating high impact and control groups, moderate accuracy (70%) between control and low exposure players, and roughly chance classification accuracy (60%) between high and low impact. The results suggest an increasing functional change with increasing head impact exposure.

CONCLUSION

Our work suggests that RSN sub-components of can be extracted from rs-fMRI using ICA, analyzed with deep learning, and that the connectivities of the DMN sub-components are altered by repeated sub-concussive head impact exposure.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates that playing a season of contact sports at the youth level, when brains are undergoing maturation, can produce neuroimaging brain changes, particularly for the DMN.

CT guided Pulsed radiofrequency treatment of the lumbar dorsal root ganglion in patients with Acute Radicular Low Back Pain

Wednesday 10:30-10:40 AM | SSK13-01 | Room: E353C

PURPOSE

To determine the clinical impact of CT-guided Pulsed Radiofrequency in the management of patients with acute or sub-acute neuro-radicular pain from lumbar disc herniation, refractory to usual therapeutic strategies.

METHOD AND MATERIALS

Patients were eligible for this single-center prospective study if they presented acute or sub-acute neuro-radicular low back pain (EMG confirmed), refractory to usual treatments (drugs and injections), and if they could safely undergo Pulsed Radiofrequency procedure. Treatment was performed using a 22-20 G needle-electrode with probe tip directed to the symptomatic DRG under CT guidance; E-pulsed radiofrequency (Cosman G4) was administered for 10 min at 45V with constant local temperature of 42°C. Clinical evaluation was conducted with Visual Analogue Scale (VAS), Oswestry Disability Index (ODI) and Roland-Morris (RM) score for quality of life assessment; all questionnaires were obtained at baseline and at 1-week, 1-month and 3-month follow-up. Analyses were performed on a per-protocol basis.

RESULTS

Over a 3-year period, 80 patients were treated with Pulsed Radiofrequency. Median VAS scores decreased from 7.8 at baseline to 3.5 at 1 week after treatment, to 2.6 at 1 month and 1.3 at 3 months; median ODI scores decreased from 78.0 at baseline to 12.5 at 1 week, to 6.0 at 1 month and 5.5 at 3 months; RM score decreased from 16 at baseline to 3 at 1 month and 1.5 at 3 months ($p < 0.001$). Overall, 90.0% of patients reached a 0 VAS score within the first month after treatment; 97.5% of patients had a decrease of at least 20 points in ODI score in the same interval. There were 6 patients considered partial responders that required a second PRF session.

CONCLUSION

CT-guided Pulsed Radiofrequency has shown to be a minimally invasive, effective and repeatable percutaneous treatment option for patients with acute or sub-acute neuro-radicular low back pain.

CLINICAL RELEVANCE/APPLICATION

the results of this study are superior to those reported from literature for usual care strategies and injections and may avoid surgery for a substantial number of patients with sciatic disc compression.

Neurotransmitters in Young People with Internet and Smartphone Addiction: A Comparison with Normal Controls and Changes after Cognitive Behavioral Therapy

Thursday 10:30-10:40 AM | SSQ16-01 | Room: N229

PURPOSE

To reveal changes in neurotransmitters in internet and smartphone addicted youth compared with normal controls and after cognitive behavioral therapy, and to identify the correlations between neurotransmitters and affective factors related to addiction.

METHOD AND MATERIALS

Institutional review board approved this prospective study and informed consents were obtained. Nineteen young persons with internet and smartphone addictions consisted of 9 males and 10 females and their mean age was 15.47 ± 3.06 years. Nineteen gender and age-matched healthy controls were also included. Nine weeks cognitive behavioral therapy was administered to 12 addicts ages 11 to 17 years. MEGA-press MRS was used to measure GABA and glutamate-glutamine (Glx) levels in the anterior cingulate cortex. GABA and Glx levels in the addicted group were compared to controls and after 9 weeks of cognitive behavioral therapy. GABA and Glx levels were correlated to clinical scales of internet and smartphone addictions, impulsiveness, depression, anxiety, insomnia and sleep quality.

RESULTS

Brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios ($p=0.028$ and 0.016) and GABA to Glx ratios ($p=0.031$ and 0.021) were significantly increased in internet and smartphone addictions. After 9 weeks of cognitive behavioral therapy, brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios ($p=0.034$ and 0.026) and brain-parenchymal volume adjusted GABA to Glx ratio ($p=0.05$) were significantly decreased. Glx was not statistically significant. Most brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios and GABA to Glx ratios were significantly correlated with clinical scales of internet and smartphone addictions, depression and anxiety.

CONCLUSION

The increased GABA level and disrupted balance between GABA and glutamate in the anterior cingulate cortex may contribute to understanding the pathophysiology of and treatment for internet and smartphone addictions. Correlations between neurotransmitters and psychology tests in internet and smartphone addictions may reveal the relation and solution to their psychological comorbidities.

CLINICAL RELEVANCE/APPLICATION

The increased GABA in internet and smartphone addicted youth and its decrease after cognitive behavioral therapy will be useful to reveal the neurobiology of comorbidities and treatment.

Self-Regulation of the Primary Auditory Cortex Activity via Directed Attention Mediated By Real-Time fMRI Neurofeedback

Monday 11:30-11:40 AM | SSC11-07 | Room: N226

PURPOSE

To determine the potential efficacy of treating auditory cortex hyperactivity by self-regulation of the primary auditory cortex (A1) based on real-time functional magnetic resonance imaging neurofeedback training (fMRI-NFT).

METHOD AND MATERIALS

10 healthy volunteers with normal hearing (no more than 1 frequency >40 dB on a standard audiogram) underwent 5 fMRI-NFT sessions. Each session was composed of a simple auditory fMRI followed by 2 runs of A1 fMRI-NFT. fMRI data was acquired using 2D, single-shot echo planar imaging during all 3 runs using a 3T. The auditory fMRI was comprised of 6 blocks, each containing a 20s period of no auditory stimulation followed by a 20s period of white noise stimulation at 90 dB. A1 activity, defined from a region using the activity during the preceding auditory run, was continuously updated during fMRI-NFT using a simple bar plot, and was accompanied by white noise (90 dB) stimulation for the duration of the scan. Each fMRI-NFT run contained 8 blocks, each separated into a 30s relax period followed by a 30s lower period. Subjects were instructed to watch the bar during the relax condition and actively lower the bar by decreasing A1 activity during the lower condition. The average A1 activity was measured from the simple auditory task from each session. Average A1 deactivation was extracted from each fMRI-NFT run, representative of A1 self-regulation performance.

RESULTS

A one-way ANOVA evaluated the effect of session on A1 activity during the simple auditory task. The main effect of session was not significant ($p = 0.41$, sphericity assumed, two-tailed). A 5x2 (session by run) ANOVA was carried out on A1 deactivation during fMRI-NFT. There was a significant effect of session ($p = 0.0275$, sphericity assumed, one-tailed) and a significant interaction effect ($p = 0.0395$, sphericity assumed, one-tailed). The most successful subjects reportedly adopted mindfulness tasks associated with directed attention.

CONCLUSION

For the first time, fMRI-NFT has been applied to teach A1 self-regulation using more than 1 session. This is important to therapeutic development as it is unlikely a single fMRI-NFT session will reverse the effects of tinnitus.

CLINICAL RELEVANCE/APPLICATION

Chronic tinnitus has implications of impaired auditory and attentional networks. Our study indicates that fMRI-NFT may provide an innovative approach to alter of these systems simultaneously.

Comparison of Sports Activity between Ambitious Triathletes with and without Myocardial Late Gadolinium Enhancement

Sunday 1:00-1:30 PM | CA205-SD-SUB1 | CA Community, Learning Center Station #1

PURPOSE

Long-term intensive training leads to functional adaptation of the heart with increase of myocardial mass. Furthermore, myocardial fibrosis occurs in a variable frequency in competitive athletes detected by late gadolinium enhancement (LGE) cardiac MRI (CMR). The purpose of this study was to analyse the differences in sports activity between triathletes with and without LGE.

METHOD AND MATERIALS

55 competitive male triathletes (44 ±10 years) underwent a CMR study performed on a 1.5 T Achieva (Philips). CMR protocol included SSFP cine, LGE imaging as well as T1 mapping. Image analysis was performed on cvi42 (Circle Cardiovascular Imaging). CMR parameters are given as the mean of two independent observers. The parameters of physical fitness were determined by an exercise test. Triathletes reported their sports history with information about the number, distance and duration of events they participated in.

RESULTS

In 10 out of 55 triathletes (18%) a non-ischaemic myocardial fibrosis of the left ventricle (LGE+) was detected. LGE+ triathletes completed significantly longer total (5610 ±3403 vs. 2406 ±2025 km, p <0.001), swimming (64 ±30 vs. 31 ±25 km, p <0.01) and cycling distances (4167 ±3023 vs. 1490 ±1114 km, p <0.001). The LV mass index was significantly higher in LGE+ triathletes (93 ±7 vs. 84 ±11 g/m², p <0.05). Likewise, the extracellular mass index and ECV was significantly higher in LGE+ triathletes (24 ±3 vs. 21 ±3 g/m², p <0.01; 26.1 ±1.8 vs. 24.4 ±2.2 %, p <0.05). LGE+ triathletes had higher peak exercise systolic blood pressure compared to LGE- triathletes (215 ±23 vs. 194 ±26 mmHg, p <0.05). Despite having comparable LVEF (63 ±8 vs. 63 ±5 %), LGE+ triathletes showed significantly higher nt-pro-BNP values (88 ±151 vs. 38 ±31 pg/ml, p <0.05), which had a significantly negative correlation with LVEF.

CONCLUSION

There is high prevalence (18%) of non-ischaemic, myocardial fibrosis among competitive male triathletes. LGE+ triathletes completed significantly longer distances compared to LGE- triathletes in their life-time competition history suggesting that the amount of exercise has an impact on myocardial fibrosis. Further, increase of nt-pro-BNP values in LGE+ triathletes may imply an early sub-clinical impairment of the LV myocardium.

CLINICAL RELEVANCE/APPLICATION

Excess of exercise might lead to myocardial fibrosis.

Prevalence, Localization and Extent of Myocardial Fibrosis in Competitive Triathletes Detected By Late Gadolinium Enhancement

Wednesday 12:15-12:45 PM | CA238-SD-WEA1 | CA Community, Learning Center Station #1

PURPOSE

Myocardial fibrosis occurs in a variable frequency of 3-50% in competitive athletes detected by late gadolinium enhancement (LGE) cardiac MRI (CMR). The purpose of this study was to examine and analyse the prevalence, localisation and extent of myocardial fibrosis in competitive triathletes using LGE CMR.

METHOD AND MATERIALS

55 competitive male (44 ± 10 years) and 30 female triathletes (43 ± 10 years) underwent a CMR study performed on a 1.5 T scanner (Achieva, Philips). The CMR protocol included SSFP Cine and LGE imaging in short and long axis as well as T1 Mapping. CMR data were analysed using cvi42[®] software (Circle Cardiovascular Imaging, Calgary, Canada). For LGE quantification the threshold method with a cut-off $>5SD$ above remote normal myocardium was used. In addition, the parameters of physical fitness were determined by an exercise test.

RESULTS

CMR revealed LV myocardial fibrosis in 10 of 55 (18%) male, but none of the female triathletes. All LGE+ triathletes revealed a non-ischemic pattern of fibrosis, typically located in the basal (70%) and mid inferolateral segments of the left ventricle. Mean LGE size was 3.2 ± 2.8 %LV (range 0.5 - 9.2 %LV) and 2.7 ± 2.3 g/m² (range, 0.5 - 7.4 g/m²). The LV mass index was significantly higher in male compared to female triathletes (86 ± 11 vs. 67 ± 9 g/m², $p < 0.0001$). The extracellular volume was higher in female compared to male triathletes ($27.8 \pm 1.9\%$ vs. $24.8 \pm 2.2\%$, $p < 0.001$). The life-time competition history showed that the number of completed Iron Man triathlons (4 ± 4 vs. 1 ± 2 , $p < 0.01$) as well as the number of middle distance triathlons (5 ± 4 vs. 2 ± 2 , $p < 0.01$) was significantly higher in the male triathlete population.

CONCLUSION

There is relative high prevalence of myocardial fibrosis (18%) in competitive male triathletes, but not in female triathletes. All LGE+ triathletes revealed a non-ischaemic pattern of myocardial fibrosis.

CLINICAL RELEVANCE/APPLICATION

The occurrence of non-ischemic LGE in the inferior and lateral LV wall suggests, that this myocardial area is prone to myocardial fibrosis under exercise. Higher sports activity in triathletes is associated with the incidence of LGE.

Large Breast Cancers in Women Attending Regular Screening: Risk Factors and Implications for Prognosis

Wednesday 12:45-1:15 PM | BR252-SD-WEB1 | BR Community, Learning Center Station #1

PURPOSE

Ever since breast cancer screening was introduced there has been a debate about its utility. A recent study focused on the persisting high incidence of large tumors despite the introduction of population-based screening programs. In this study, we aim to identify risk factors associated with tumors not being detected until larger than 2 cm, and to examine the implications for long-term prognosis.

METHOD AND MATERIALS

We examined a population-based screening cohort of 2,358 cases of invasive breast cancer incident between 2001 and 2008. The main outcome was a tumor size larger than 2 cm, compared to smaller. Multiple adjusted odds ratios for the association between percent density (PD), body mass index (BMI) and other patient characteristics and the main outcome were estimated. We followed the patients until 2016, and estimated age-adjusted hazard ratios for disease progression – defined as the first of locoregional relapse, distant metastasis or death due to breast cancer. All analyses were stratified by detection mode.

RESULTS

For screen-detected cancers, both BMI (Odds Ratio (OR): 1.33 per 5 kg/m²) and PD (OR: 1.26 per 10%PD) were associated with having a large tumor at diagnosis. However, for interval cancers, only BMI (OR: 1.56) was associated with having a large tumor, while PD (OR 0.81) was associated with having a small tumor. Nulliparity was only significant among screen-detected cases (OR 1.45). Large tumors were associated with worse prognosis than smaller ones (Hazard Ratio (HR): 2.66). Women with higher BMI had worse prognosis than women with lower BMI - among interval cancers only (HR 2.01). PD showed no significant association with disease progression.

CONCLUSION

BMI is the only risk factor consistently associated with being detected with a tumor larger than 2 cm - overall, among screen-detected cancers and among interval cancers. Among interval cancers, BMI was associated with worse prognosis.

CLINICAL RELEVANCE/APPLICATION

In light of our findings, efforts to improve breast cancer screening by finding tumors while they are still small and improve prognosis, should focus on shortening the time interval between screenings for women with high BMI.

Cortical Thickness Abnormalities in Non-Comorbid Medication-Naive Patients with Major Depressive Disorder and Patients with Social Anxiety Disorder

Thursday 12:45-1:15 PM | NR394-SD-THB4 | NR Community, Learning Center Station #4

PURPOSE

An overlap of clinical symptoms between major depression disorder (MDD) and social anxiety disorder (SAD) suggests similar brain mechanisms of the two disorders. However, few studies directly compare the brain structure between the two disorders. Aim of this study was to assess cortical thickness alterations between non-comorbid medication-naive MDD patients and SAD patients.

METHOD AND MATERIALS

High resolution T1 weighted images were acquired from 37 non-comorbid MDD patients, 24 non-comorbid SAD patients and 41 healthy controls (HC). Vertex-based analysis of cortical thickness (corrected with clusterwise probability of $p < 0.001$) were performed and groups differences were compared by ANOVA analysis followed by post-hoc analysis.

RESULTS

Both MDD and SAD patients, relative to HC, showed cortical thickening in the bilateral medial prefrontal cortex, posterior dorsolateral prefrontal cortex, insular cortex, left temporal pole, and right superior parietal cortex; cortical thinning in the left lateral OFC and bilateral rostral middle frontal cortex. Besides, MDD patients showed specifically greater thickness in left fusiform, right lateral occipital cortex; thinner thickness in bilateral lingual, and left cuneus; SAD patients showed specifically thinner cortical thickness in the right precentral cortex. Furthermore, there were significant negative correlations between HAMD score and cortical thickness in the left SFC, right caudal MFC and right insula in MDD group.

CONCLUSION

Our results indicated that MDD and SAD share a common pattern of gray matter abnormalities in sacilence network and dorsal attention network. In addition, we found disorder-specific involvement of the visual recognition network in MDD and the fear circuitry in SAD.

CLINICAL RELEVANCE/APPLICATION

These consistent structural differences in the two patient groups may contribute to the broad spectrum of emotional, cognitive and behavioural disturbances observed in MDD patients and SAD patients. These findings provide new evidence of shared and specific neuropathological mechanisms underlying MDD and SAD.