to investigate if there is an association between infecting P.a. variants (nonmucoid, mucoid, or mixed populations), the lung lobes in which these variants are found, and regional proinflammatory cytokine production. METHODS/STUDY POPULATION: We performed BAL on 16 CF patients with clinically stable disease. For each patient, we obtained BAL fluid from the right upper lobe, right middle lobe, right lower lobe, left upper lobe, lingula, and left lower lobe. We plated BAL fluid on nonselective and P.a.-selective medium to quantitate bacteria and to identify P.a. colony subtypes (nonmucoid, mucoid, or mixed). We further used a V-PLEX human cytokine array to quantitate inflammatory cytokine concentrations (IL-1β, TNF-α, IL-6, IL-8, and IL-10) within BAL fluid specimens. Our specimen collection was approved by the local IRB with informed consent and assent obtained from patient volunteers. RESULTS/ANTICIPATED RESULTS: Based on microbiological analysis, each lobar BAL specimen was classified as uninfected with P. a. or infected with nonmucoid, mucoid, or mixed (both nonmucoid and mucoid) P.a. variants. There was no observed propensity of mucoid or nonmucoid variants to be confined to certain lung lobes in our cohort. However, infection with mucoid P.a. variants was associated with higher concentrations of IL-1β ($p < 0.001$), TNF-α ($p < 0.001$), IL-8 ($p < 0.001$), and IL-10 ($p < 0.001$) within lobar BAL fluid compared with P.a.-free specimens. Specimens with mucoid variants also had greater concentrations of TNF-α ($p < 0.01$), IL-8 ($p < 0.001$), and IL-10 ($p < 0.05$) compared with specimens with only nonmucoid P.a. variants. Patients infected with mixed mucoid and nonmucoid variants showed higher concentrations of TNF-α and IL-10 ($p < 0.05$) as well as nonsignificant trends for higher concentrations of IL-1β and IL-6 compared to P.a.-free samples. Interestingly, the presence of nonmucoid P.a. variants was inversely correlated with IL-6 ($p < 0.05$). Total bacterial burden (both P.a. and non-P. a. species) within BAL fluids was positively correlated with higher proinflammatory cytokine concentrations. Additionally, independent of bacterial colonization, the upper lobes (right upper lobe and left upper lobe) of the lungs showed trends towards higher proinflammatory cytokine concentrations compared with the lower lobes (right lower lobe and left lower lobe). DISCUSSION/SIGNIFICANCE OF IMPACT: Our results demonstrate that P.a. variants (mucoid or nonmucoid) appear not to be geographically restricted in ability to colonize any lobe of the CF lung. Moreover, infection with mucoid P.a. (either alone or in mixed populations with nonmucoid variants) is associated with higher inflammatory cytokine concentrations in the CF lung. Given that infection with mucoid P.a. predicts deterioration in pulmonary function, this study provides a rationale for further investigation of cytokines as diagnostic/prognostic correlates of infection and lung disease in CF.

2012

Multivariate air pollutant exposure prediction in South Carolina

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OBJECTIVES/SPECIFIC AIMS: The objective of this project is the application of complex fusion models, which combine observed and modeled data, to areas with sparse monitoring networks with multiple chemical components is under-developed. Such models could provide improved accuracy and coverage for air quality measurement predictions, an area greatly limited by the amount of missing data. METHODS/STUDY POPULATION: This project focuses on the development of methods for improved estimation of pollutant concentrations when only sparse monitor networks are found. Sparse monitoring networks are defined as areas where fewer than three criteria air pollutants (based on EPA standards) are monitored. Particularly, a multivariate air pollutant statistical model to predict spatio-temporally resolved concentration fields for multiple pollutants simultaneously is developed and evaluated. The multivariate predictions allow monitored pollutants to inform the prediction of nonmonitored pollutants in sparse networks. RESULTS/ANTICIPATED RESULTS: Daily, ZIP code level pollutant concentration estimates will be provided for 8 pollutants across South Carolina, and goodness of fit metrics for model variants and previously established methods will be compared. DISCUSSION/SIGNIFICANCE OF IMPACT: These methods utilize only widely available data resources, meaning that the improved predictive accuracy of sparsely monitored pollutant concentrations can benefit future studies in any US area by improving estimation of health effects and saving resources needed for supplemental air pollutant monitoring campaigns. Our method for estimation attempts to improve predictive accuracy and data availability for sparsely monitored pollutants and areas.

2334

Neural correlates of externally Versus internally guided dance-based therapies for people with Parkinson's disease

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OBJECTIVES/SPECIFIC AIMS: Parkinson's disease (PD) is a condition that affects over a million Americans, and despite current medical therapies, the progression of the disease results in impaired generation of internally timed or guided (IG) movements. To address this loss of motor function, previous rehabilitation therapies have focused on remediating the affected striatal-thalamic-cortical circuits (STC), primarily thought to be responsible in generating timed motor patterns. However, given the disease leads to the cell death of dopaminergic cells that are essential for proper STC function, we propose a motor therapy aimed at utilizing a compensatory parallel cerebellar-thalamic-cortical (CTC) pathway, recruited to perform externally guided (EG) movements, in which gait initiation is driven from sensory input. Our previous study has shown efficacy in our novel argentine tango therapy and improves behavioral measures above the relevant MCID threshold, but it has not been established that the CTC are in the causal pathway that are responsible for these changes. Using neural measures from task fMRI, we have begun to characterize networks that have changed and quantify any associations with behavioral metrics. METHODS/STUDY POPULATION: Patients were randomly assigned to an IG (n = 18), EG (n = 18), or education contact control (n = 14). Participants were assessed preintervention and postintervention for behavioral motor and cognitive measures and neurophysiologically with task based fMRI. In the task, participants performed a foot tapping task under both IG (tap their foot in previously learned rhythm) or EG (tap immediately after receiving a tactile cue on their hand) conditions. The fMRI data were preprocessed using AFNI and registered to MNI standard space. The brainnetome atlas was applied and the average time series of each region of interest (ROI) was used to increase the signal to noise ratio. The activation of these ROI with respect to the stimulus was modeled using GLM, and we estimated the area under the curve during the task blocks. A 1-way ANOVA analysis on these betas were performed between the pre and the post intervention time points and the ROIs that were above a significance of 0.95 were identified and corrected for multiple comparisons. The change in beta in all ROIs for each individual were calculated and then correlated with the changes in the behavioral data, to see which changes in ROI areas matched the best with the behavioral changes. RESULTS/ANTICIPATED RESULTS: The EG group showed significant changes only in the EG task in 2 areas—inferior frontal gyrus and inferior temporal sulcus. Correlating to the cognitive behavioral measures show reduced error from the Inferior frontal gyrus (corr > 0.5) best reflect changes in observed. There were no changes to either the STC or the CTC pathways. The IG group showed no changes behaviorally and showed no changes neurally as well. The control group showed no changes behaviorally, but neuronally certain DMN nodes, such as the precuneus and inferior temporal regions showed a significant change for both tasks. DISCUSSION/SIGNIFICANCE OF IMPACT: Addressing the damaged STC pathway directly through IG therapy may not be effective. The EG therapy may not be able to enhance the STC pathway. However, the therapy appears to utilize new areas in the frontal regions and correlates with positively with changes in spatial memory and balance tasks. Contrary to our hypothesis the CTC circuit was not upregulated for performance of the IG or EG task, but therapy may have enhanced recruitment of other cognitively engaged areas. The educational control group interestingly showed changes in the DMN network, which has been shown to be linked to attention during tasks blocks.

2288

Neural correlates of face processing in autism spectrum disorder: A quantitative meta-analysis of current literature and future directions

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OBJECTIVES/SPECIFIC AIMS: Autism spectrum disorder (ASD) affects 1 in 68 people and includes restricted, repetitive behavior, and social communication deficits. Aspects of face processing (i.e., identity, emotion perception) are impaired in some with ASD. Neuroimaging studies have shown aberrant

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patterns of brain activation and connectivity of face processing regions. However, small sample sizes and inconsistent results have hindered clinical utility of these findings. The study aims to establish consistent patterns of brain responses to faces in ASD and provide directions for future research. METHODS/STUDY POPULATION: Neuroimaging studies were identified through a multi-database search according to PRISMA guidelines. In total, 23 studies were retained for a sample size of 383 healthy controls and 345 ASD. Peak coordinates were extracted for activation likelihood estimation (ALE) in GingerALE v2.3.6. Follow-up ALE analyses investigated directed Versus undirected gaze, static Versus dynamic, emotional Versus neutral, and familiar Versus unfamiliar faces. RESULTS/ANTICIPATED RESULTS: Faces produced bilateral activation of the fusiform gyrus (FG) in healthy controls (−42 −52 −20; 22 −74 −12, $p < 0.05$, FDR) and left FG activation in ASD (−42 −54 −16, $p < 0.05$, FDR). Activation in both groups was lateral to the mid-fusiform sulcus. Follow-up results pending. DISCUSSION/SIGNIFICANCE OF IMPACT: Reduced right FG activation to faces may inform biomarker or response to intervention studies. Mid-fusiform sulcus proved a reliable predictor of functional divides should be investigated on a subject-specific level.

2091

Neurophysiological substrates and developmental sequelae of sensory differences in infants at high risk for autism spectrum disorder

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OBJECTIVES/SPECIFIC AIMS: Background: Children with autism spectrum disorder (ASD) show a broad range of unusual responses to sensory stimuli and experiences. It has been hypothesized that early differences in sensory responsiveness arise from atypical neural function and produce "cascading effects" on development across a number of domains, impacting social and communication skill, as well as broader development in children affected by ASD. A primary challenge to confirming these hypotheses is that ASD cannot be definitely diagnosed in the earliest stages of development (i.e., infancy). A potential solution is to prospectively follow infants at heightened risk for ASD based on their status as infant siblings of children who are diagnosed. We examined the developmental sequelae and possible neurophysiological substrates of three different patterns of sensory responsiveness—hyporesponsiveness (reduced or absent responding to sensory stimuli) and hyperresponsiveness (exaggerated responding to sensory stimuli), as well as sensory seeking (craving of or fascination with certain sensory experiences). Infants at high risk (HR) for ASD were compared with a control group of infants at relatively lower risk for ASD (LR; siblings of children with typical developmental histories). Objectives: Research questions included: (a) Do HR infants differ from LR infants in early sensory responsiveness?, (b) Does sensory responsiveness predict future ASD and related symptomatology? and (c) Is sensory responsiveness predicted by resting brain states? METHODS/STUDY POPULATION: Methods: To answer these questions, we carried out a longitudinal correlational investigation in which 20 HR infants and 20 LR controls matched on sex and chronological age were followed over 18 months. At entry to the study, when infants were 18 months old, sensory responsiveness was measured using the Sensory Processing Assessment and the Sensory Experiences Questionnaire, and a number of putative neural signatures of early sensory differences were measured via resting state EEG. When infants were 24 and 36 months of age, ASD and related symptomatology was evaluated in a comprehensive diagnostic evaluation. RESULTS/ANTICIPATED RESULTS: Results: HR infants trended towards increased hyporesponsiveness and hyperresponsiveness and showed significantly elevated levels of sensory seeking relative to LR controls at 18 months of age. Both groups, furthermore, displayed a high degree of heterogeneity in sensory responsiveness. Atypical sensory responsiveness (increased hyperresponsiveness and/or hyporesponsiveness, as well as sensory seeking behavior) predicted several aspects of ASD and related symptomatology, including social, communication, and play skill, and was associated with differences in resting brain state, including metrics of oscillatory power, complexity, and connectivity, as well as hemispheric asymmetry. Moderation analyses revealed that several relations varied according to risk group, such that associations were stronger in magnitude in the HR Versus LR group. DISCUSSION/SIGNIFICANCE OF IMPACT: Conclusion: Findings provide empirical support for the notion that early sensory responsiveness may produce cascading effects on development in infants at heightened risk for ASD. Differences in resting brain states may underlie atypical behavioral patterns of sensory responsiveness. From a clinical standpoint, results suggest that early sensory differences may be useful for predicting developmental trajectories, and be potentially important targets for early preventive intervention, in infants at risk for autism.

2523

Noninvasive biomarkers for inflammatory bowel disease: Drawbacks and potential

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OBJECTIVES/SPECIFIC AIMS: Approximately 1.6 million Americans suffer from inflammatory bowel diseases (IBD), ulcerative colitis, and Crohn's disease. It is a challenge for both physicians and patients alike to manage the disease, primarily due to lack of disease specific biomarkers. Endoscopy remains the gold standard to diagnose and evaluate IBD activity. Current biomarkers or their combinations cannot adequately predict IBD progression or relapse, and response to therapy. METHODS/STUDY POPULATION: In total, 97 IBD patients recruited at University of Kentucky undergoing endoscopy. Patients medical information was collected from electronic database including C-reactive protein (CRP), fecal calprotectin (FC), endoscopy/pathology report. RESULTS/ANTICIPATED RESULTS: The mean CRP and FC levels were 1.3 (normal <1) and 679 (normal <162), respectively. FC (sensitivity 74%) was more reliable to predict mucosal inflammation compare to CRP (sensitivity 36%). However, 52% of patients did not have FC performed (vs. CRP only 4%), and 45% of these patients failed to submit stool sample for analysis. DISCUSSION/SIGNIFICANCE OF IMPACT: Our data suggests FC is the most promising noninvasive marker for disease monitoring in IBD. It correlates well with endoscopic activity and mucosal inflammation. However, further analysis must be done to evaluate barriers to testing and issues with compliance from patients. We feel strongly that a blood biomarker for disease activity is vital for disease monitoring and response to therapy in IBD.

2336

Novel PGF2a synthesis pathway in epithelial ovarian cancer

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OBJECTIVES/SPECIFIC AIMS: To understand the role of PGF2a and to characterize a novel cyclooxygenase (COX)-independent prostaglandin synthesis pathway in epithelial ovarian cancer. METHODS/STUDY POPULATION: We used high grade epithelial ovarian cancer cell line (OVCAR3) as a model to study our pathway. Our main mode of PGF2a detection is through mass spectrometry. RESULTS/ANTICIPATED RESULTS: Our current results suggest the OVCAR3 cells may synthesize PGF2a independently of COX enzymes. We anticipate this novel pathway may be dependent on the TGFb pathway. DISCUSSION/SIGNIFICANCE OF IMPACT: Understanding the role and synthesis pathway of PGF2a may allow us to uncover a novel therapeutic pathway for high grade ovarian cancer.

2126

Optimizing a technique for visualizing retinal and choroidal blood flow noninvasively

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OBJECTIVES/SPECIFIC AIMS: Diabetic retinopathy is an increasingly prevalent disease, difficult to screen for across the globe. We have developed and began optimizing an innovative technique to visualize and quantify retinal blood flow, to elucidate the role of the choroid in retinal pathologies such as diabetic retinopathy or choroidopathy. METHODS/STUDY POPULATION: Preliminary retinal was obtained from a surgical retina video library (Truvision, Goleta, CA, USA). Videos of different organs were recorded while vessels were occluded via a blood pressure cuff, using consumer-grade digital video cameras (NEX-5T, a7sii; Sony, New York, NY, USA). All other retinal videos were taken using a fundus camera (50×; Topcon, Oxland, NJ, USA) modified to support the above digital video cameras. All videos were processed using experimental software (MATLAB, Mathworks, Natick, MA, USA). RESULTS/ANTICIPATED RESULTS: Video imaging of the retina was optimized for lighting conditions and software requirements. Parameters were defined for the software imaging pipeline, such as frequency range of interest, sampling rate, and noise minimization. Software was developed to stabilize frames, accounting for eye saccades. Use of a biosensor enabled accurate measurement of pulse waveform, increasing signal-to-noise ratio. The optimal light requirements were determined such that adequate exposure of the retina is reproducible yet still

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