development. OBJECTIVES/GOALS: Spray-dried dispersion (SDD) tablet formulation is an approach to increase oral drug solubility and absorption. Methods to predict SDD performance in humans are poorly developed. We aim to develop an in vivo in vitro correlation (IVIVC) between in vitro dissolution and in vivo absorption of itraconazole SDD tablets. METHODS/STUDY POPULATION: This research project involves tablet manufacturing, in vitro dissolution experiments, and a clinical study. We manufactured fast-, medium-, and slow-release SDD tablets containing amorphous solid dispersion of itraconazole (100 mg) and different grades of the polymer hypromellose acetate succinate (HPMC-AS). Tablets differed in slug pressure, tablet compression force, and formulation composition. Dissolution studies were performed using the United States Pharmacopeia (USP) type II apparatus. The clinical study is an ongoing randomized, cross-over, open-label, fasted, single-dose trial in healthy participants (n=12). An IVIVC will be created by comparing the rank order of drug in vitro dissolution with in vivo absorption. RESULTS/ANTICIPATED RESULTS: Tablet manufacturing was successful, and the tablets displayed the same dissolution rate ranking order as anticipated. Fast-release tablets showed the highest percentage of drug dissolved by 10 min (74%) compared to medium- (62%) and slow-release (1.2%) tablets. Percentage drug dissolved differs by at least 10% at all time points among the different release-rate tablets. The clinical study is currently ongoing, and we expect that the pharmacokinetic (PK) profiles differ among the different tablets. We predict that the rank order of tablet absorption in humans will agree with the order of drug dissolved observed in the dissolution experiments. DISCUSSION/SIGNIFICANCE OF FINDINGS: Spray-dried dispersions are a formulation method to try to improve drug solubility and oral drug absorption. This research will elucidate manufacturing parameters that can impact tablet performance and expand on the ability of in vitro dissolution to predict human PK and streamline drug development of poorly soluble drug candidates.

Team Science

35156

Sensory mechanisms of atypical motor variability and regularity in autism spectrum disorder*

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ABSTRACT IMPACT: This project aims to better understand mechanisms of sensory and motor deficits in individuals with ASD with the goal of informing diagnosis and treatment development. OBJECTIVES/GOALS: Over-reliance on both visual and proprioceptive feedback have both been observed during motor behavior in persons with Autism Spectrum Disorders (ASD), suggesting that separate sensory feedback processes may be selectively altered during different behaviors. The objective of this study is to clarify sensory mechanisms of fine motor control in ASD. METHODS/STUDY POPULATION: Participants with ASD (N=43) and controls (N=23) matched on age (10-20 yrs) and non-verbal IQ completed tests of precision gripping. Participants were instructed to press on force sensors with their index finger and thumb so that a moving bar corresponding to their force output reached and stayed as stable as possible at the level of a stationary target bar. Visual feedback was manipulated by changing the visual gain of the force bar (low, medium and high). The force bar moved more per change in force output at higher gains. Proprioceptive feedback was manipulated by applying 80 Hz tendon vibration at the wrist to induce an illusion of muscle contraction. This was compared to a condition with the tendon vibrator turned off. Force variability (standard deviation) and regularity (sample entropy) were examined. RESULTS/ANTICIPATED RESULTS: Controls showed increased force variability with the tendon vibration on compared to off (t = -3.372, p < 0.001); however, the ASD group showed no difference in force variability between the tendon vibration conditions (t = -0.960, p = 0.338). Individuals with ASD had stronger age-associated reductions in force variability relative to controls across tendon vibrator and gain conditions (Group x Age: t = -4.05, p < .001). The ASD group also had greater age-associated increases in force regularity relative to controls, especially at higher gain levels (Group x Gain Level x Age: t = -3.22, p = 0.001). Unlike the ASD group for whom regularity increased with age in both tendon vibration conditions, controls only showed these age-related gains when the tendon vibrator was off (Group x Vibration Frequency x Age: t = 2.46, p = .014). DISCUSSION/SIGNIFICANCE OF FINDINGS: Our findings indicate that while controls integrate proprioceptive and visual feedback online to accurately adjust fine motor behavior, persons with ASD rely mostly on visual feedback. Our results suggest delayed development of sensory integration and reduced reliance on multisensory feedback during online fine motor control in persons with ASD.

Translational Science, Policy, & Health Outcomes Science

13623

Daily relationship between social connectedness and health behaviors among dementia family caregivers

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ABSTRACT IMPACT: Knowledge of which aspects of social connectedness most strongly associate with caregiver health and health behaviors can inform intervention targets to improve caregiver health OBJECTIVES/GOALS: Stressed dementia caregivers are at risk of poor health. Social connectedness may reduce adverse health effects, yet it is unknown about which aspects relate most strongly to health. This is a barrier to intervention development. Our study identifies aspects of social connectedness most strongly associate with caregivers' daily health behaviors. METHODS/STUDY POPULATION: Data. Enrolled spousal caregivers completed 14 consecutive days of online surveys. Measures. We examined multiple health behaviors each day, which included: 1) number of occurrences of 3 potential binge-eating behaviors (range 0 to 30), 2) whether participants engaged in at least 30 minutes of physical activity, and 3) perceived sleep quality, rated 1 (very bad) to 5 (very good). We also examined a count of health symptoms caregivers experienced (e.g., backache; range: 0 to 7). Measures of social connectedness included: spousal emotional support, perceived spousal appreciation, emotional support from any source, and loneliness. Analysis. We applied bivariate multi-level mixed effects models to examine the association between each aspect of social connectedness and health behaviors day-to-day. RESULTS/ANTICIPATED RESULTS: Since November 2020, 5 of N=40 participants were enrolled, of whom 3 had completed all diary surveys. Participants were women ages 59 to 73, and included 4 non-Hispanic white and 1 Hispanic caregivers. Data included 51 days of surveys (93% adherence). No

differences in eating behaviors nor physical activity according to social connectedness were found. Emotional support from any source was positively associated with sleep quality (B= 0.20; SE=0.08; p-value 0.015). On days when caregivers indicated their spouse appreciated them 'A lot' versus 'Not at all,' sleep quality was marginally better (B=0.73, SE=0.42; p-value-0.08). Finally, days when caregivers felt lonely at least 'Some of the time' versus 'Not at all' were associated with experiencing more adverse health symptoms (B=1.54; SE=0.58; p-value<0.001). DISCUSSION/SIGNIFICANCE OF FINDINGS: Improved emotional support from any source may support better sleep quality among caregiving spouses, while loneliness appears to contribute to more adverse health symptoms. Findings, if confirmed, can be translated to develop intervention programs that target loneliness and perceived emotional support among caregivers.

47982

Reversing the resistance to chemotherapy in White and Black patients with triple negative breast cancer (TNBC).

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ABSTRACT IMPACT: Reversing tumor microenvironment (TME) immunosuppression will help to increase the overall efficacy of treatment of chemo-resistant triple negative breast cancer (TNBC) and mitigate racial disparities in treatment response. OBJECTIVES/ GOALS: We have developed an ex-vivo whole tissue culture model to test the feasibility of reversing local immunosuppression in TME by chemokine modulatory (CKM) regimen. Our current objective is to analyze the molecular changes in CKM-treated chemoresistant TNBC from White and Black women and identify factors determining response to CKM. METHODS/STUDY POPULATION: Freshly resected residual TNBC from 20 White and 20 Black women ≥18 yrs old treated with neoadjuvant chemotherapy (NAC) will be procured. Tumor explants will be prepared & cultured in the absence and presence of CKM (Interferon-δ ›¼, TLR3 agonist rintatolimod and COX-2 inhibitor celecoxib). Chemokines implicated in cytotoxic T-lymphocyte (CTL)- & MDSC/ Treg attraction will be analyzed using Taqman & ELISA. We will have 80% power to detect a 0.7 standard deviation difference in chemokines between untreated & treated samples within and between cohorts using ANCOVA. Bulk RNA sequencing will be performed on both untreated & treated samples from CKM responding (highest aggregate increase in CTL- and highest decrease in Treg/MDSC-favoring chemokines in the top quartile) and non-responding (bottom quartile) tissues. RESULTS/ ANTICIPATED RESULTS: Our preliminary data show that Black patients (pts) with breast cancer (BC) have an immunosuppressive TME associated with poor outcomes. This is similar to other existing literature showing that Black pts with BC have less favorable and more unfavorable chemokines in the TME. We anticipate the chemokine changes with CKM treatment will be larger in the Black cohort given their ability to elicit a robust inflammatory response. Therefore, we expect that CKM treatment will result in favorable TME in both groups and improve outcomes in TNBC, which has the worst prognosis of all subtypes, eliminating a key area of disparity in BC. The proposed transcriptome analysis will help identify key gene networks involved in response to CKM treatment and guide modulating the targets for non-responsiveness to improve efficacy of CKM. DISCUSSION/SIGNIFICANCE OF FINDINGS: Pts with residual disease (RD) after NAC have a 3-yr overall survival 68% vs. 94% for pts with complete response. Blacks have a higher incidence of TNBC with more likelihood of RD & mortality. We anticipate that the existing TME differences can be abrogated by our current CKM regimen or via developing an alternative CKM regimen optimized for Black pts.

55484

Dual activation of CAR and Nrf2 improves the efficacy: toxicity ratio of cyclophosphamide and doxorubicin-based treatment of TNBC

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ABSTRACT IMPACT: Triple negative breast cancer (TNBC) affects 10-20% of women with breast cancer and is biologically more aggressive than other subtypes. The novel compound we have developed, DL7076, would give clinicians a vital strategy to improve the commonly used cyclophosphamide (CPA) and doxorubicin (DOX) regimen in the treatment of TNBC. OBJECTIVES/GOALS: The objective of this research project is to develop a novel compound which can activate both 1) the constitutive androstane receptor (CAR) and subsequently enhance the CYP2B6-mediated activation of CPA, and 2) the nuclear factor erythroid- related factor-2 (Nrf2) leading to the cardiomyocyte protection from DOX-associated cardiotoxicity. METHODS/STUDY POPULATION: Following the identification of the compound candidate, DL7076 was evaluated for tissue specific induction of CAR and Nrf2 using qPCR, western blot analysis, and luciferase reporter assays.
Further, we have developed a multicellular coculture model incorporating human primary hepatocytes for metabolism, TNBC spheroids as the target, and cardiomyocytes as a side target of DOX. We have investigated the anticancer effects of CPA/DOX on TNBC cells and the toxic effects on cardiomyocytes with/without a CAR-Nrf2 activator, in a multicellular environment where hepatic metabolism is well-retained. RESULTS/ANTICIPATED RESULTS: We found that our dual activator of CAR and Nrf2, DL7076, exhibits tissue specific induction of CAR and Nrf2. Inclusion of DL7076 in combination with the CPA/DOX regimen improves anticancer efficacy, through the subsequent increase in the formation of the active CPA metabolite. With the addition of DL7076, DOX-mediated off-target cardiotoxicity was markedly reduced.

Lastly, utilizing the novel coculture system with human primary hepatocytes, TNBC spheroids, and cardiomyocytes, the inclusion of DL7076 to the CPA/DOX regimen shows decreased spheroid viability and improved cardiomyocyte viability and function. DISCUSSION/SIGNIFICANCE OF FINDINGS: Our findings suggest that DL7076 can facilitate DOX/CPA containing regimens by increasing CAR-mediated metabolism and subsequent CPA bioactivation while selectively protecting cardiomyocytes from DOX-induced toxicity. This research is expected to translate our basic scientific findings into therapeutic interventions for women with TNBC.