Mild cognitive impairment among older adults with diabetes: A pilot study in San Juan, Puerto Rico

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OBJECTIVES/GOALS: Research on mild cognitive impairment (MCI) risk factors in type 2 diabetes mellitus (T2DM) is scarce; however, MCI is a concern in T2DM as it can adversely impact self-care behaviors. This study aims to estimate the proportion of MCI and describe its sociodemographic, clinical, psychosocial, and lifestyle characteristics in older adults with T2DM. METHODS/STUDY POPULATION: Cross-sectional pilot study of 60 adults (aged ≥50yrs) with a diagnosis of T2DM will be recruited at a diabetes center located in San Juan, Puerto Rico. Data on sociodemographic, clinical, psychosocial (depressive symptoms and social support), and lifestyle characteristics related to diabetes self-management (diabetes self-care activities and activities of daily living) will be collected through face-to-face interviews using validated questionnaires. Our primary outcome will be MCI assessed via the Spanish-language version of the Montreal Cognitive Assessment (MoCA-S). The proportion of adults with MCI (MoCA-S score<26) will be estimated, and the sociodemographic, lifestyle, psychosocial, and clinical characteristics of older adults will be compared across MCI status using bivariate analysis. RESULTS/ANTICIPATED RESULTS: Expected results include an estimate of the proportion of MCI among older adults with T2DM, which we hypothesize will be higher in our study than in Puerto Rico's older adult population (previously reported as 17%). Additionally, we will describe the sociodemographic, clinical, psychosocial, and lifestyle characteristics that significantly differ by MCI status in older adults with T2DM. We expect that those with MCI will be more likely to be females, have lower education and annual income, longer time with a diabetes diagnosis, worse psychosocial profiles (higher levels of depressive symptoms and lower levels of social support), and worse lifestyle profiles (poorer glycemic control and lower activities of daily living score) than those without MCI. DISCUSSION/SIGNIFICANCE: This pilot study is a first step to understanding MCI among older adults with T2DM in Puerto Rico, a Hispanic population with a higher prevalence of T2DM than their US non-Hispanic White counterparts. Its findings can guide the design and implementation of a larger epidemiological study aimed at understanding MCI risk factors among adults with T2DM.

A Multifaceted Approach to Improving Fish Farming in Kenya's Lake Victoria Region

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OBJECTIVES/GOALS: This project adopts a multifaceted approach to improving aquaculture management practices in Kenya's Lake Victoria region by identifying fish pathogens, measuring algal toxin levels in commonly consumed fish, surveying fish farming practices, and educating the public. METHODS/STUDY POPULATION: Limited existing data on the state of floating cage culture in Kenya influenced our decision to begin this portion of the project with a brief literature review of potential Nile tilapia pathogens. Databases were screened for mention of disease in either wild or caged Nile tilapia, with emphasis given to those in Lake Victoria. Results were compiled into a spreadsheet and analyzed for frequently occurring pathogens. The next portion involved creating an interview style survey to assess current cage culture management practices in the region. Editing was done to ensure questions remained unbiased, non-leading, culturally sensitive, multilingual and relevant to the situation. Data went through a quality control screening and analysis was conducted through the R programming language. RESULTS/ANTICIPATED RESULTS: Beginning with mortality, of the 93 farms surveyed, data analysis revealed that there is a higher probability that farms will have a mortality of approximately 20%, over the course of a production cycle. For biosecurity and fish health practices, data shows that 97% of farms do not disinfect scooping nets or other fish handling materials when moving from one cage to another. During the 2022-2023 production cycle, 44% of farms experienced fish kills of over 50 fish. 73% of the 93 farms do not contact any organization when a fish kill occurs. In a qualitative answer, it also appears that many farm workers dispose of their dead fish within the lake, feed it to livestock or dogs, or eat it. Algae blooms have been experienced at 80% of the farms surveyed and 43% of farms say they have seen fish gasping at the surface for air. DISCUSSION/SIGNIFICANCE: While farms are implementing good management practices in the areas of cage design, stocking, and feeding practices, there is room for improvement in fish health, biosecurity, and managing algal blooms. The findings provide insight into the areas that should be considered when taking action to improve the welfare of the region.

Contemporary Research Challenges

Unraveling the role of placental trophoblast cells in preeclampsia

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OBJECTIVES/GOALS: Changes associated with placental vasculature contribute to the progression of gestational hypertensive disease preeclampsia. Caudal-type homeobox-2 (CDX2) regulates trophoblast stem cell differentiation. In this study, we investigate the role of placental CDX2 cells in healthy pregnancy and in conditions of preeclampsia. METHODS/STUDY POPULATION: To understand the role of CDX2 cells, here we collected human placenta samples from the prospectively enrolled cohort and also the de-identified cohort (n=84). We studied CDX2 distribution, and function using a lentivirus-based approach. We studied the CDX2 expression and functional differences using transcriptomics and examined the function in invasion and vasculogenesis in the presence and absence of the new target genes we have discovered in our study. RESULTS/ANTICIPATED RESULTS: Analysis of healthy human placenta samples showed that CDX2-expressing cells were present in fetal

chorionic regions and are associated with HLA-G and cytokeratin-7 confirming their trophoblast identity. CDX2 cells demonstrated the potential to form a capillary network akin to endothelial cells. Placental samples from healthy (n=6) and preeclampsia (n=8) patients revealed higher levels of CDX2 expression in preeclampsia. Within preeclampsia CDX2 cells, Natriuretic peptide receptor 1 (NPR1), RET oncogene, and Homeobox D10 (HOXD10) were significantly differentially regulated, including a unique long-non-coding anti-sense RNA (KANSL1-AS1) that affected the function of CDX2 and trophoblast cells in invasion and normal vasculogenesis. DISCUSSION/SIGNIFICANCE: In sum, based on these observations, the present study postulates that CDX2 cells present in a healthy human placenta may serve as a prospective cellular reservoir for angiogenesis. Conversely, altered gene programs within CDX2 cells cause aberrant vascular function that could contribute to the progression of preeclampsia.

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Allogeneic Recellularized Lung Orthotopic (ARLO) Transplant Research

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OBJECTIVES/GOALS: As of 2021, the lung transplantation waiting list has a mortality rate of 7.6 deaths per 100 patient-years. Bioengineered human organs is an emerging field of tissue engineering with a goal of developing suitable organs for transplantation. The focus of the project is to evaluate the efficacy of bioengineered lungs using a human-to-swine model. METHODS/STUDY POPULATION: This project will involve designing and assessing the bioengineered lung by establishing a human-to-pig xenotransplantation survival model. The project aims to evaluate how well the bioengineered lung functions within a living model. The bioengineered lung is constructed using swine connective tissue scaffolding, which has been recellularized with human cells. Anatomically, the lung will resemble a swine lung but will possess the immunological and cellular markers of human tissue. The proposed model will initially assess the immunological response of swine to human lung tissue. Lung function will be assessed during surgery using pulmonary vein gas samples and tissue sampling. Following the end of the study, additional tissues samples will be taken to evaluate the immunological response to the tissue. RESULTS/ANTICIPATED RESULTS: Xenotransplantation and bioengineered organs are two new emerging fields of research that have just begun to enter the large animal testing phase. This model will provide a novel human-to-pig xenotransplant survival model that will be used to test the efficacy of bioengineered lungs function in a dynamic living organism. The design has taken the principles of immunology learned from the current clinical and xenotransplant research and has incorporated this knowledge into the known pig-to-pig transplant models. We anticipate that this model design will be easily reproducible and can be expanded to other bioengineered organs as an effective means to test functionality. DISCUSSION/SIGNIFICANCE: The COVID-19 pandemic's aftermath may lead to an increased demand for lung transplants. Bioengineered lungs could provide an additional source of organs to supplement current availability. This novel approach has the potential to offer a means to test several different types of bioengineered organs in the future.

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Detecting and monitoring Salmonella infection and chronic carriage in living mice using bioluminescent in vivo imaging

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OBJECTIVES/GOALS: SalmonellaTyphi primarily persists in human chronic carriers by forming biofilms on gallstones in the gallbladder (GB). We developed a mouse model of GB chronic carriage, and using this model, aim to detect Salmonella in living mice and track the progression of GB carriage with bioluminescent S.Typhimurium and in vivoimaging. METHODS/STUDY POPULATION: S.Typhimurium 14028 (WT) was transduced with the lux operon from the S. Typhimurium Xen33 strain from Perkin Elmer©, creating 14028lux. 129X1/SvJ mice were fed a lithogenic diet for 6 weeks to induce gallstone formation. After cessation of diet, these mice were infected with 5x103-1x104 colony forming units (CFU) of either the 14028lux isolate, WT (non-luminescent) isolate, or an equal volume of sterile saline. Mice were serially imaged (IVIS SpectrumCT) every 2-3 days for up to 63 days. Images were quantified by measuring average radiance over selected regions of interest. The presence of bioluminescent bacteria in specific organs was confirmed by imaging the abdominal cavity post-mortem. Organs were homogenized and CFUs per mg of tissue were quantified and compared between each group. RESULTS/ANTICIPATED RESULTS: Compared to the controls, mice infected with 14028lux showed luminescence in the abdomen as early as three days post-infection. Within 15 days, the resolution was sufficient to discriminate signal in specific organs, notably the gallbladder, liver, spleen, and cecum. The presence of bacteria was confirmed in these organs via direct imaging and by quantifying CFUs in the tissues. At 63 days post-infection, we identified >103 CFUs and significant luminescence in the GB of a portion of 14028lux-infected mice. For all days post-infection, 14028lux-infected mice that lacked observable luminescence had <100 CFUs/mg tissue. DISCUSSION/SIGNIFICANCE: We have developed a technique using bioluminescent S.Typhimurium and in vivo imaging that, without sacrificing infected mice, enables us to reliably distinguish between mice that have maintained gallbladder chronic carriage >60 days and those that have cleared infection.

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Testing the effects of rigid encapsulations on bovine primordial follicle quiescence versus growth

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OBJECTIVES/GOALS: There is an interest in developing a bioprosthetic ovary for ovarian tissue transplantation. The properties of the ovarian extracellular matrix need to be better understood in order to replicate the human ovary. We tested the effects of an encapsulating hydrogel at different rigidities on bovine primordial follicle activation, growth, and survival. METHODS/STUDY POPULATION: Bovine primordial follicles were isolated from ovarian cortex. A mean of 9.9 follicles (range 3-24) were encapsulated per bead in either 1% or 5 % alginate across 4 experiments. The encapsulated