Group Talk

Medical Group News — For Our Physicians

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SEPTEMBER 26, 2022

A Novel Approach to Predict Intercranial Aneurysm Rupture by Combining Brain Imaging and Gut Microbiome Biomarkers Through Artificial Intelligence

Pictured left to right: Dr. Shlomit Schaal, Dr. Max Rosen, Dr. Anna Luisa Kühn, Dr. Mohammed Salman Shazeeb, Dr. Nils Henninger and Dr. Clifford Lindsay.

About one in every 50 people in the United States has an unruptured brain aneurysm. Currently, no reliable method exists to predict when or if an aneurysm will burst, despite a brain aneurysm rupturing approximately every 18 minutes. Ruptured brain aneurysms are fatal in 50% of cases, and in the nonfatal ruptures, nearly 70% of patients suffer from severe, permanent, and debilitating neurological damage.

The ability to predict when and if an intracranial aneurysm will rupture, along with appropriate timely intervention, would prevent patients from suffering devastating loss of neurological function and even death. Artificial intelligence (AI) has shown incredible success in analyzing anatomical images and predicting a wide variety of medical conditions, and it shows promise for predicting aneurysm rupture. However, because it is unclear whether there is sufficient information within the imaging biomarkers, the team of Mohammed Salman Shazeeb, PhD, Assistant Professor, Department of Radiology; Anna Luisa Kühn, MD, PhD, Assistant Professor, Department of Radiology; Clifford Lindsay, PhD, Assistant Professor, Department of Radiology; Beth McCormick, PhD, Professor and Vice Chair, Department of Microbiology and Physiological Systems; Vanni Bucci, PhD, Associate Professor, Department of Microbiology and Physiological Systems; and Nils Henninger, MD, PhD, Dr Med, Associate Professor of Neurology, wanted to explore further a recent and new area of research that has shown increasing evidence of a bidirectional relationship between brain physiology and gut microbiota that can have a role in the pathogenesis of neurological disorders.

“Of interest for this project is the identification of specific gut bacteria that may be responsible for causing the rupture of intracranial aneurysms,” explained the team in their Prize for Academic Collaboration and Excellence (PACE) submission. “Machine learning approaches are being implemented to identify patterns in the composition of the microbiome with respect to diseases; however, predictions of the occurrence or timing of an aneurysm rupture has not yet been successfully established and more research is required in this area.”

The doctors propose to develop an AI model that uses state-of-the-art brain imaging techniques with the latest research in gut microbiome-brain connection, that can predict accurate timing of aneurysm rupture based on combined brain imaging and microbiome data.

“We hope to make a difference in the field of aneurysm diagnosis using our method of applying brain imaging and gut microbiome analysis to predict the status of an aneurysm before it ruptures,” shared Dr. Salman Shazeeb. “This method could potentially help screen and identify patients for treatment in a more reliable manner in the future.”

Once proven successful in the mouse model, their goal is to translate the AI model to a clinical setting where it can be an invaluable tool in guiding the neurointerventionalists through continued funding. Following research development, clinical trials, and FDA approval, they will endeavor toward commercialization.

“The PACE program helps bring clinicians and researchers together on the same platform to solve some medical problem that would not necessarily be achieved if they worked on the problem by themselves,” said Dr. Salman Shazeeb. “This opportunity allowed us to apply for some seed ffunds, which are what we needed to do some initial experiments for our project before proceeding to apply for larger grants.”