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PHYSIOLOGICAL STRESSORS TRIGGERING DISEASE IN THE HEART

MMRI Investigates Overlapping Phenomena in the Heart as Result of Electrocution

UTICA, NY — It's not uncommon for people to live normal, healthy lives without knowledge of any underlying genetic conditions. However, all it takes is one external impact, such as a heart attack, to induce the expression of the condition. This is exactly the situation that occurred in an individual who was severely electrocuted in a work accident. Indeed, following the accident the patient began exhibiting signs of multiple cardiac arrythmias, or irregularities in the normal beating of the heart. In a study recently published at the Masonic Medical Research Institute (MMRI), Dr. Jonathan Cordeiro found that the individual actually had two overlapping cardiac conditions. "We had previously seen similar situations in individuals who had suffered heart attacks, where a sudden stressor event increases susceptibility to heart diseases later in life. In this situation, electrocution was the physiological stressor that resulted in long-term cardiac alterations," said. Dr. Cordeiro.

In his research, Dr. Cordeiro and his team used fibroblasts (skin cells) from the electrocuted patient to generate human induced pluripotent stem cells (hiPSC). This type of cell can be directed to any cell type of interest, such as cardiomyocytes (heart cells) to study disease under tissue culture conditions. "The nice thing about stem cells is they are patient specific. Not everyone responds the same way to a drug, but with access to a patient's cells, we can determine how those cardiomyocytes respond to drug treatment and develop a more personalized and patient-specific approach to therapeutic strategies. Through our research, physicians can make more informed decisions for a specific patient's treatment regiment," said Ryan Pfeiffer, co-author and Research Associate at MMRI.

The use of hiPSC, together with a combination of a myriad of other techniques, such as calcium imaging, electrophysiology, and field potential analysis, the mechanisms by which genetic mutations cause cardiac arrhythmias can be systematically determined. In this case, the electrocuted individual was shown to carry several genetic mutations linked to Early Repolarization Syndrome and Short QT Syndrome, two very severe cardiac arrhythmia conditions that can lead to sudden cardiac death. Importantly, knowing that the individual carries these mutations can help clinicians better and more effectively treat the conditions, to allow for a longer and healthier life. "This study is an excellent example of investigators from different areas of expertise working together to resolve a common problem. It was enjoyable to work with the other co-authors," said Jacqueline Treat, a Research Associate and co-author on the manuscript.

"These overlap phenomena are likely to be of some significance. Indeed, many scientists want to divide syndromes neatly into one category or another but as your paper illustrates there may well be a continuum in which overlap phenomena occur," said Dr. Jules C Hancox, Professor of Cardiac Electrophysiology at University of Bristol.

The manuscript titled, "Overlap Arrhythmia Syndromes Resulting from Multiple Genetic Variations Studied in Human Induced Pluripotent Stem Cell-Derived Cardiomyocytes," was published in the International Journal of Molecular Science (IJMS) special issue, "The Magnificent World of Induced Pluripotent Stem Cell-Derived Cardiomyocytes," on July 1, 2021. A link to the publication can be found at the following website: doi.org/10.3390/ijms22137108

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