Research pinpoints sources of atrial fibrillation

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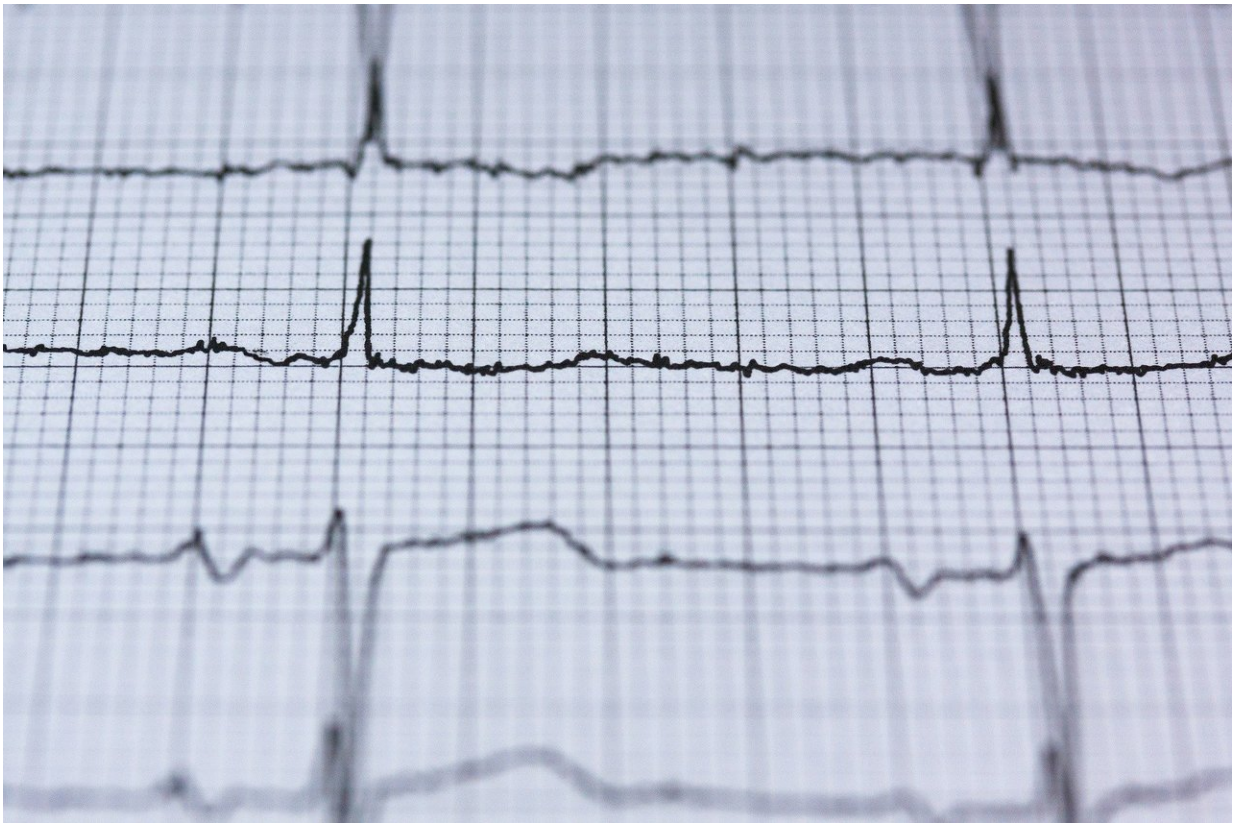

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People who suffer from persistent atrial fibrillation in the heart may find relief from a new treatment approach discovered by researchers at The Ohio State University Davis Heart and Lung Research Institute.

Atrial fibrillation is an irregular heartbeat, or a condition in which the atria fail to contract in a strong, rhythmic way. It's the most prevalent cardiac arrhythmia in the United States and a leading cause of stroke, heart failure and other complications.

Cardiovascular researchers studying the mechanisms of atrial fibrillation found that adenosine, a chemical present in human cells and used in clinical practice, may help physicians pinpoint the exact spot of the arrhythmia source, resulting in more effective ablation (destruction of a small amount of heart tissue that's causing the irregular heart rhythms) and possible end of recurring atrial fibrillation. This improved method of identifying drivers of atrial fibrillation was applied to a pilot clinical trial of 10 patients.

Scientists at The Ohio State University Wexner Medical Center also discovered that atrial fibrillation drivers don't always have the shape of a closed loop but may instead consist of "hubs" where the electrical activity of atrial fibrillation is multiplied much like a small tornado. The study results were reported in the *Journal of the American Heart Association*.

"Thinking of atrial fibrillation drivers as hubs may change the way we interpret mapping results of the heart to identify these drivers. Finding these reentrant atrial fibrillation drivers is key for doing targeted ablation and successfully treating AFib," said Vadim Fedorov, professor of physiology and cell biology at the Ohio State College of Medicine and lead author of the study.

At least 2.7 million Americans live with atrial fibrillation, with some suffering from persistent atrial fibrillation that lasts for longer than seven days at a time. When medications don't work, physicians use ablation.

When doing an ablation, physicians use a CAT scan or MRI of the heart to establish anatomy and create an electrical map showing where to do the procedure. But current clinical multi-electrode maps can be difficult for clinicians to interpret because of the structurally complex 3-D atria, or top portion of the heart.

"Some of these atrial fibrillation drivers may be missed entirely or falsely identified, resulting in faulty targeting of heart tissue," Fedorov said. "Successful treatment of persistent atrial fibrillation depends on accurate identification of these drivers. It's critical that we have a better understanding of how the mechanisms of atrial fibrillation drivers work in order to enhance clinical driver ablation."

Ohio State researchers have been able to study living human atria with persistent atrial fibrillation outside the body and created the most accurate computer models of human atria to date by using a 3-D imaging technique created by Fedorov. By injecting novel fluorescent dye into the atria and using infrared light, scientists were able to see through the atrial wall and precisely determine where the atrial fibrillation drivers were, which isn't possible with current clinical mapping tools.

The human hearts were donated for research by patients of Lifeline of Ohio and the Division of Cardiac Surgery at the Ohio State Wexner Medical Center.

Researchers found that using adenosine can stabilize atrial fibrillation drivers, which improves their detection on clinical mapping systems.

"These study results are exciting. The use of adenosine can improve mapping where atrial fibrillation drivers are not easily identifiable and allow us to more accurately find the exact source of these drivers and ablate. In our study, 80% of patients who had persistent atrial fibrillation were helped by this safe method," said Dr. John Hummel, director of

Clinical Electrophysiology Research at the Wexner Medical Center, who led the clinical part of the research.

Now that Fedorov and his team have identified atrial fibrillation drivers as hubs of activity, the next step is to study what makes regions of the heart more susceptible to becoming a hub, such as scar tissues or fibrosis within the heart muscle. Knowing this could result in new therapies to help prevent atrial fibrillation.

More information: Brian J. Hansen et al. Unmasking Arrhythmogenic Hubs of Reentry Driving Persistent Atrial Fibrillation for Patient-Specific Treatment, *Journal of the American Heart Association* (2020). DOI: 10.1161/JAHA.120.017789

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