

Restoring the Heart's Normal Rhythm with Ablation:

Pulmonary Vein Isolation Technique

By Scott P. Edwards

More than 2 million Americans know the feeling. The sudden, pounding sensation that feels like their heart is about to jump out of out their body. The pain and pressure in their chest. The shortness of breath.

Electrophysiologists at Baystate Medical Center are now using a relatively new approach to treat atrial fibrillation (AF) by ablating the tiny areas of tissue that cause this abnormal rhythm, thus restoring the heart's normal sinus rhythm and preventing the formation of stroke-inducing blood clots.

Misfiring Muscle Cells

During a normal heartbeat, an electrical impulse in the sinoatrial (SA) node fires and spreads through the two atria, causing them to contract and forcing blood into the ventricles. The ventricles then contract, forcing blood out of the heart to the lungs and the rest of the body. The normal heart beats in a constant, repetitive rhythm, with about 60 to 100 beats per minute at rest.

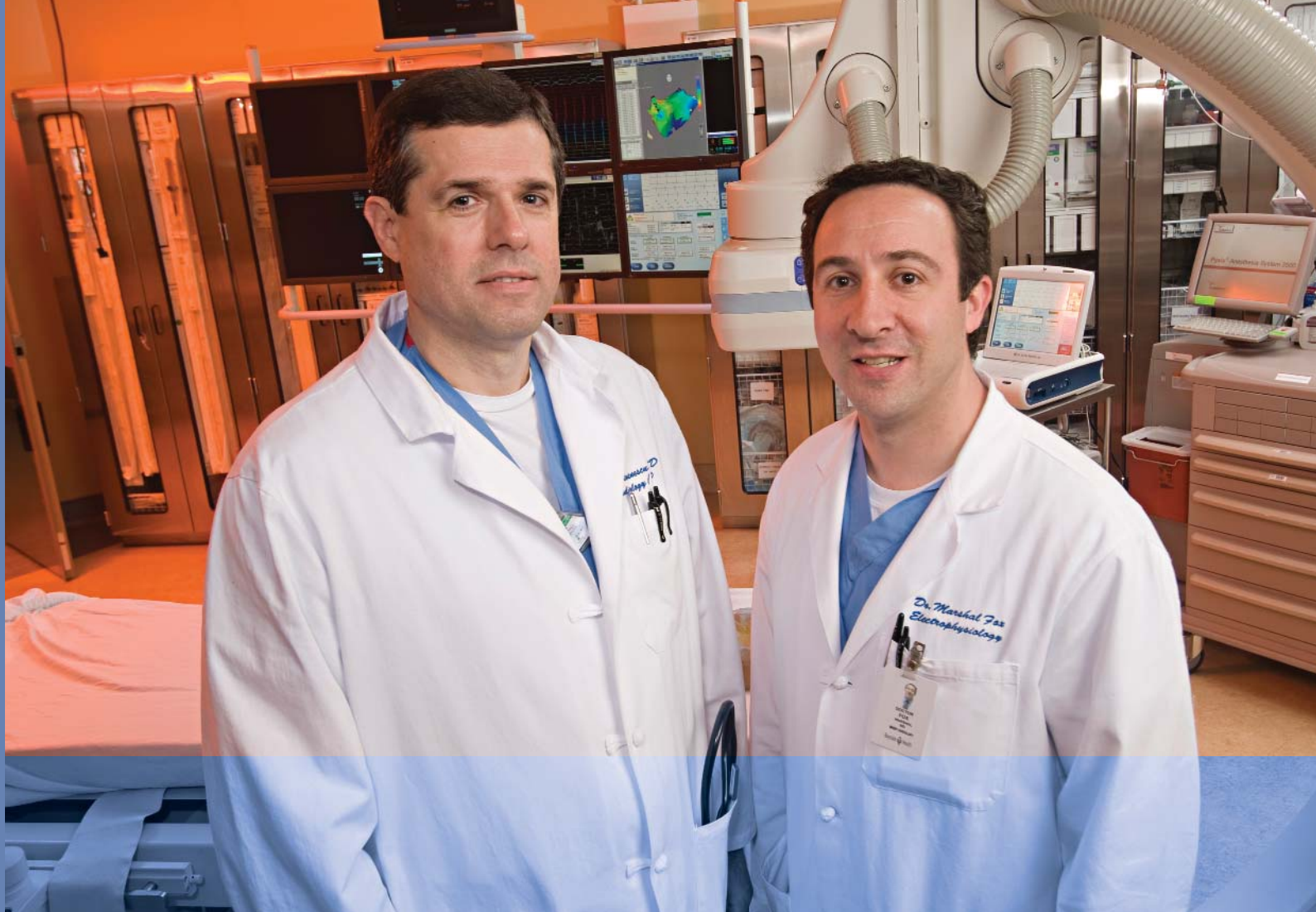
When a person has AF, the most common type of heart arrhythmia, the orderly electrical impulses that drive the heart become rapid and disorganized, sometimes raising the atrial rate to as high as 300 to 600 beats per minute, and the ventricular rate up to 200 beats per minute, causing a racing sensation in the chest.

"We've found that there are 'sleeves' of muscle cells in these veins that are identical to heart cells," says Mathias L. Stoenescu, MD, a Baystate electrophysiologist. "These cells become electrically active for some unknown reason. They fire much more rapidly than the normal sinus rhythm and take over the heart's pacemaker function."

Atrial fibrillation increases the risk of clot formation and thus stroke. Over time, untreated AF can lead to heart failure and may even increase the risk of premature death.



By ablating the tiny areas of tissue that cause atrial fibrillation, electrophysiologists at Baystate can restore the heart's normal sinus rhythm and prevent the formation of blood clots. (Shown: Dr. James Cook, director, Cardiac Electrophysiology.)



Baystate electrophysiologists Drs. Mathias Stoenescu and Marshal Fox, say that PVI is much more challenging to perform than other ablation procedures used to treat different forms of arrhythmia.

Pulmonary Vein Isolation

Treatment options for AF include medications, lifestyle changes, and ablation procedures. Because scientists know that most of the abnormal electrical impulses originate in the four pulmonary veins, the quest has been to develop an effective means of interrupting these irregular signals.

Nearly 10 years ago, French doctors began using catheters to find these areas of abnormal tissue and cauterize them to eliminate AF. The technique was effective, says Dr. Stoenescu, but carried side effects, including scarring that narrowed the pulmonary veins, causing the method to be abandoned.

A relatively new ablation technique, pulmonary vein isolation (PVI), is increasingly being used to treat AF with excellent results. During the procedure, a flexible catheter with an electrode attached to the tip is

inserted into the femoral vein in the groin and directed toward the heart. Once inside the left atrium, radiofrequency (RF) energy heats up the electrode, and the electrophysiologist creates circular scars around the pulmonary veins to prevent electrical impulses from firing in the openings of the pulmonary veins.

“We ablate these veins by burning circles at the junction where the pulmonary veins meet the left atrium,” says Marshal T. Fox, MD, a Baystate electrophysiologist. “We basically isolate the veins at the left atrium, hence the term pulmonary vein isolation.”

Drs. Fox and Stoenescu say that PVI is much more challenging to perform than other ablation procedures used to treat different forms of arrhythmia. Because the catheter must travel from the right atrium into the left atrium, electrophysiologists must perform

a transseptal catheterization. During this procedure, a needle is used to make small hole in the septum dividing the two atria. The catheter is then threaded from one atrium to the other. After the procedure, the hole closes on its own.

“Access from the right atrium to the left is more difficult and takes longer,” says Dr. Stoenescu. “Also, trying to isolate the pulmonary veins by going in a point-to-point fashion so the electrical current can’t slip through is tedious work.”

The average PVI procedure takes four to five hours to complete compared to other ablation procedures, which typically take less than two hours.

Outcomes and Risks

PVI is most effective in the initial stages of atrial fibrillation — paroxysmal AF — during which the heart beats in a normal rhythm with occasional episodes of arrhythmia. Dr. Fox says patients with paroxysmal AF respond well to the procedure, with a 70 to 80 percent success rate.

The procedure’s effectiveness goes down in cases of persistent AF, when the arrhythmia is usually present with infrequent, short-lived episodes of normal sinus rhythm, and in permanent AF, in which patients are almost always in atrial fibrillation. “In the latter two stages of AF,” says Dr. Stoenescu, “the success rate drops to around 60 percent.”

While PVI is effective at stopping atrial fibrillation, it is not without risk. As with any catheterization, there is a slight risk of damaging blood vessels when the catheter is inserted and directed toward the heart. Ablating in or near the pulmonary veins can, in some cases, lead to stenosis and reduced blood flow to the heart. In addition, cauterizing the tissue can increase the risk of blood clots, which if dislodged, can lead to stroke.

Pulmonary vein isolation is increasingly being used to treat AF, with excellent results.

Perhaps the most serious complication of PVI is atrial-esophageal fistula between the left atrium and the adjacent esophagus caused by the RF energy used to ablate abnormal tissue. Dr. Fox says that while atrial-esophageal fistula is a “dangerous” complication, it is rare, occurring in less than one percent of patients.

The biggest challenge doctors face in controlling atrial fibrillation is learning more about the condition. “Ablation for other forms of arrhythmia has a 90 to 100 percent success rate,” says Dr. Fox, “because we know more about and understand these types of arrhythmias and how to get rid of them. We’re still learning about AF and how it responds to ablation.”

For more information

or to refer a patient, call 413-794-7246.