A Patient Guide to Electrophysiology Study and Catheter Ablation

Sinus Node
AV Node
Right Bundle Branch
Left Bundle Branch
Left Atrium
Right Atrium
Left Ventricle
Right Ventricle

Peter Munk Cardiac Program
Preparing for the EP Study and Ablation
Do's and Don'ts Before the EP Study
Commonly Asked Questions
The EP Procedure
The Ablation
Treatments

University Health Network’s Electrophysiology team is here to assist you, to minimize your anxiety, to teach you about your specific heart condition and possible treatments, and to answer all your questions. We look forward in meeting with you and your family to discuss a personal treatment plan for you. In the meantime, these pages will help you and your family understand the procedure and treatments that will be most effective for you.

Preparing for the EP Study and Ablation

Before your EP study, you should:

- get specific instructions about the food you may eat -- you will be asked not to eat or drink for 6 to 8 hours before the procedure to prevent nausea;
- make arrangements with a friend or family member to drive you to and from the hospital;
- bring all of all your current medications to the hospital;

You will be instructed to stop taking certain medications several days before the procedure to assure more accurate results; also, blood thinners such as warfarin (Coumadin), dabigatran (Pradax), rivoroxiban, and apixaban are usually stopped 2-5 days beforehand. If you are taking a blood thinner, please make sure your doctor knows about this.
If you have been told by your doctor you are having an ablation, we recommend you start taking one coated aspirin a day, four days prior to your procedure and stay on it for 6 weeks following the ablation. This prevents platelets from gathering around the ablation site and forming clots.

Be sure to mention allergic reactions you have experienced from any medications to the doctor or nurse, but also remember that a side-effect (like nausea) and an allergy are not necessarily the same thing.

Sometime prior to your procedure, your doctor, will review your medical history and examine you. He or she will also explain the purpose of the procedure, its potential benefits and possible risks. Because an EP study is "invasive," requiring the insertion of catheters into the body, it involves some risk. The risk is small, however, and the study is relatively safe. Most patients who undergo EP studies do not experience complications, but you should discuss your particular risk factors with your doctor, as well as any questions, concerns or feelings you have.

You and your family will be scheduled to meet with our, Electrophysiology Nurse Coordinator or Nurse Practitioner, several days before your procedure in the Pre-Admission Clinic, on the 6th Floor of the Clinical Services Building at 586 University Ave. He or she will instruct you on your arrhythmia, electrophysiology study, catheter ablation procedure, and will answer any questions that you may have. Also, preadmission tests, such as lab work, Chest Xray and a 12 lead EKG, will be performed during this visit.

**THINGS TO DO AND NOT TO DO BEFORE YOUR ELECTROPHYSIOLOGY OR CATHETER ABLATION PROCEDURE AT UHN**

**DO** Take your medicines as usual, unless our office tells you otherwise. Please inform our office if you are on Coumadin, other oral blood thinner, or medications for your heart rhythm.

**DO** Bring your medicines to the hospital.

**DO** Bring any medical records or lab results that
your personal physician asks you to take to the
doctors who will be performing your
electrophysiology study. Make sure your
referring doctor has sent copies of any cardiac
studies you might have had, and EKG’s of your
arrhythmia (if available) to us at UHN

**DO** Pack a small bag with personal toiletries if you
like for your hospital admission.

**DO** Eat a regular supper the evening before your
electrophysiology study.

**DO** Eat or drink anything after 12:00 midnight, the
night before your test unless instructed to do
otherwise by the Nurse Practitioner or Nurse
Coordinator during your preadmission visit.
Also, do not drink any water unless you need to
take your regular morning pills on the day of
the procedure, but take your pills with only a
sip of water enough to swallow them. You may
brush your teeth and rinse your mouth the
morning of the procedure.

**DO** Bring large sums of money or valuables to the
hospital unless family or friends coming with
you will hold them during the electrophysiology
study.

We would like to make your stay at UHN as pleasant and comfortable
as possible. If you have any Arrhythmia questions, please feel free to
call our Electrophysiology Nurse Coordinators (Juliet Wilson and
Sharlene Abdool, or Nurse Practitioners (Nancy Marco at 416-340-
4800 extension 4532 and Jenny Pak)

Commonly Asked Questions

1. **Since this is a teaching hospital, who will be doing my
procedure?**
During your electrophysiology study and procedure, catheters will
be placed by our Electrophysiology fellows, who are cardiologists
that are specializing in Electrophysiology, the electrical
conduction system of the heart. The Electrophysiologist, who is also known as the Attending and who you are scheduled to do the procedure with, is at the control station, viewing and directing the placement of the catheters on our X-Ray screen, stimulating and diagnosing your abnormal heart rhythm, locating the exact spot where your abnormal rhythm is coming from and directing where radiofrequency energy should be applied to "cure" you of your abnormal heart rhythm. There will also be two - three electrophysiology lab nurses and technicians to provide care and comfort to you during the procedure.

2. **Will the Electrophysiology Study and Catheter Ablation procedure be performed at the same time?**
   Yes, the Electrophysiology Study and Catheter Ablation procedure will be performed during the same session. Once we locate exactly where your abnormal rhythm is located by the Electrophysiology Study, we will apply radiofrequency energy to this area during the radiofrequency Catheter Ablation procedure. We wouldn't want to put you through two different procedures when it can all be done at one time.

3. **How many Electrophysiology Studies and Catheter Ablation procedures have you done?**
   Our four Electrophysiologists perform over 400 catheter ablation procedures per year; this high volume ensures efficiency and expertise in the treatment of arrhythmias. We receive referrals from all parts of the world because of our expertise and state-of-the-art technology.

4. **Will the procedure hurt?**
   You may feel minor discomforts during the Electrophysiology Study from lying flat on our X-Ray table, or from the injection of the numbing medicine where catheters will be placed, or intermittently feel your heart racing when the doctors try to induce your abnormal heart rhythm. But through most of the procedure, you should be lightly sedated. To minimize any discomforts during the procedure, you will be given short acting sedatives to make you calm throughout the procedure.
5. **Is the electrophysiology study and catheter ablation procedure safe?**
   Yes, the electrophysiology study and catheter ablation procedure are relatively safe. With any procedure, there are potential risks. The risks will be fully covered by our physicians before you have your electrophysiology study and catheter ablation procedure. The electrophysiology study and catheter ablation procedure are performed safely on children and adults, with the youngest at 3 months old and the oldest at 87 years old.

6. **How long is the procedure?**
   During the Electrophysiology Study and Radiofrequency Catheter Ablation Procedure, you will be in our EP lab for 1 to 6 hours. Please let your family and friends know the length of the procedure time so that they do not worry.

7. **Why does a catheter need to go in my groin?**
   Two to four catheters will be placed in your femoral vein. The catheters will be inserted in the right groin and will enter your heart from the bottom. By placing four catheters into the heart, it allows your doctor to manipulate the catheters in different directions to locate where your abnormal rhythm is coming from and to ablate it. Once the catheters are removed from the groin site, you will have a very tiny hole, looking very much like a "bug bite". The site should not leave a scar and there are no sutures to be removed.

8. **What can I expect immediately following my Electrophysiology Study and Catheter Ablation?**
Immediately following your procedure, you will return to your room. You will be on bedrest for 4-6 hours. You will need to keep your right leg straight for several hours, to minimize the risk of bleeding.

If you need to urinate, you should ask for a urinal or a bedpan. The head of your bed will be elevated slightly, to make you more comfortable.

The nurse will frequently check your blood pressure, pulses in your feet, and your groin for signs of bleeding.

You may eat and drink if you wish.

9. **How long will I need to stay in the hospital?**
   For the Electrophysiology Study and Catheter Ablation procedure, you will be able to go home the same day or the next day, around 9:30 to 10:30 A.M.

10. **When can I resume my normal activities?**
    You can resume your normal daily activities (walking, bathing, showering, etc.) upon discharge from hospital unless instructed differently. The only restriction is straining or lifting heavy objects more than 10 pounds for 5-7 days so that the incision site can heal. Avoid any vigorous activity such as playing football, basketball, exercising, etc. for one week. You may experience some tenderness and bruising in your groin and upper leg. This is a natural process, however if the pain is excessive or continuous, please have your family doctor or closest emergency clinic examine it.

11. **When can I go back to work?**
    Unless your job requires you to lift heavy objects, you can return to work in 3-4 days.

12. **Will I feel my heart race after my ablation?**
During the few days following your ablation, it is common to have the sensation that your heart is trying to race. This is caused early beats, which previously would have started your heart racing, but which now are unable to cause a fast rhythm. However, if you know you have a fast heartbeat, you should call your doctor for an evaluation.

13. Will I come back here for follow-up? 
Upon discharge from the hospital, you will receive specific follow-up instructions by our Electrophysiology team. Our Nurse Clinician or Nurse Practitioner will write a detailed letter, describing your hospital stay and treatment, to your personal physician. Your Electrophysiologist will let you know when he would like to see you in follow-up.
University Health Network
Electrophysiology Laboratory

New Technologies and Approaches
to Arrhythmia Problems

The UHN electrophysiology group participates in the development and testing of many new and innovative arrhythmia treatment strategies. These range from evaluation of advanced mapping technologies for identifying the origin of abnormal rhythms and assessment of state-of-the-art arrhythmia pacemakers and defibrillators, to developing high-resolution intra-cardiac ultrasound devices to visualize the heart during catheter studies.

Heart Rhythm Disorders: Arrhythmias

Arrhythmia is the term used to describe a heart rhythm that is not normal. There are two broad categories of arrhythmias: abnormally slow heartbeats, called bradycardias (from the Latin brady=slow + cardia=heart), and excessively fast heartbeats, tachycardias (tachy=fast).
**Bradycardias--Slow Heart Beats**

**Description:**
Abnormally slow heart rhythms can result from the failure of your SA node to start the normal pacemaker impulse. Slow heartbeats also can be caused by defects in your conduction system that prevent the electrical impulses from reaching your ventricles. This is called heart block. By interrupting the impulse before it reaches your ventricle, your ventricle may fail to contract and therefore fail to pump blood effectively. (Figure 2a)

These conditions may result from normal age-related changes to your conduction system, damage to your conduction system after a heart attack, or occasionally due to a variety of other conditions. If the impulse is not started, or not sent to your ventricles, the result may be irregular heartbeats and ineffective pumping of blood as shown. During the pauses in between the slow heartbeats, your blood pressure usually drops. You may feel symptoms of palpitations (heart-fluttering or pounding), or dizziness. If blood is not effectively pumped to your brain for more than a few seconds, fainting results.

**Treatment Options:**
Usually, medications are not effective in treating slow heartbeats. Bradycardias are usually treated by implanting a pacemaker. A pacemaker is a small, self-contained, battery-powered device. It is usually implanted below your skin just under your collarbone. (Figure 2b)

The implant procedure typically takes about one hour, and most patients leave the hospital the same or next day.

The pacemaker continuously monitors your heart’s electrical activity, and generates an electrical impulse to stimulate your heart’s contraction if your heart beats too slowly.
Tachycardias--Fast Heart Beats

**Description:**
Fast heart rhythms beginning above your ventricles, in your atria can have symptoms of palpitations (pounding in your chest), dizziness, chest pain, clamminess, and shortness of breath. These abnormally fast rhythms frequently occur in people who do not have any heart disease, and can affect children, young adults, and older adults. These abnormal rhythms are usually due to electrical signals that form "short circuits" and fast heart beats (Figure 3A).

Tachycardias, or abnormally fast heartbeats, are divided into two categories: supraventricular tachycardias (fast heart beats that begin above your ventricles in your atria), and ventricular tachycardias (fast heart beats that begin in your ventricles). If your heart beats too fast, there is not enough time between contractions for your ventricles to fill with blood and pumping becomes ineffective.

**SVT- Supraventricular Tachycardias**

**Treatment Options:**
In the past, supraventricular tachycardias were treated only with medications. Since the late 1980’s and early 1990’s, a procedure called a catheter ablation has been developed to treat some supraventricular tachycardias. In a catheter ablation procedure, steerable catheters (flexible, insulated, wires) are placed into a leg vein in the groin, and guided to the heart. During the diagnostic portion of the study, the location of the extra pathway, or source of
extra heartbeats is determined. The catheter is then placed next to the region responsible for the abnormal rhythm and a type of energy called radiofrequency energy is delivered through the catheter. This procedure destroys the abnormal cells responsible for the fast rhythms, or supraventricular tachycardias. For most supraventricular tachycardias, the success rate for catheter ablation is greater than 90% and can result in a permanent cure. For these reasons catheter ablation has become the first choice for treatment of many supraventricular arrhythmias, preventing the need for life-long medication use and possible medication side effects.

WPW - Wolff Parkinson White Syndrome

Abnormal Heart Rhythms Associated with WPW

In patients with Wolf-Parkinson-White syndrome (WPW) or atrioventricular nodal re-entrant tachycardia, the electrical impulse may return to the upper chamber over an abnormal extra connection that typically has been present since birth. The returning electrical impulse may once again go down the "normal" conduction system, creating
an additional heartbeat. Each time this cycle repeats itself, the heart beats. Rapid heart beating is simply the repeating of this kind of cycle many times. This process is the most common mechanism of an arrhythmia in patients with extra connections. In some patients, more serious and potentially life threatening abnormal rhythms may develop. The most common of the serious rhythm problems is atrial fibrillation. In this arrhythmia, the electrical activity in the upper chambers becomes chaotic, electrically activating as fast as 300-400 times per minute. When this happens in patients without an extra pathway, the normal conduction system only allows a fraction of these beats to reach the ventricles. In patients with WPW and an extra pathway, however, it is possible for up to 300-350 of the electrical impulses to travel from the upper to the lower chambers each minute. If the rate of the lower chambers reaches 300-350 beats per minute, the heart's ability to effectively pump blood is radically altered, and a patient may either pass out or, in some cases, lose any effective heartbeat and die. Fortunately, most patients with the WPW syndrome are not at this kind of risk because their pathways will not go that fast. The best way to determine the exact level of risk in an individual patient is to initiate this chaotic rhythm in the electrophysiology laboratory and determine its effect in a very controlled setting.

Electrophysiology Testing for Evaluation of Patients with WPW

Because of the presence of these arrhythmias, patients are referred for further evaluation and treatment recommendations. Most patients undergo an electrophysiology (EP) study or electrical catheter testing to determine the location of the extra connection, study the cause of the clinical rhythm problems, and to determine the risk to which the patient would be exposed if atrial fibrillation developed. In an EP study, catheters (flexible wires) are passed to the heart to study its electrical system, and to determine whether an extra pathway is present. The risk of this EP study is low and is actually less than that with routine coronary angiography performed to look for blockages in the arteries around the heart. This will be discussed with you in detail by your physician if an EP study will be done.
Treatment of Patients with WPW and AV Nodal Reentrant Tachycardia

Based on the results of the EP study, recommendations for ultimate therapy for the extra pathway and arrhythmias can be made. The most common treatment options include drug therapy, open heart surgery, and radio frequency catheter ablation of the extra pathway.

Medical therapy has been used for patients with WPW and atrio-ventricular nodal re-entrant tachycardia, and a number of different drugs are available to prevent the abnormal rhythm from occurring. Usually, drug therapy requires taking medication two or three times each day. This form of therapy offers the opportunity for arrhythmia control without going through open heart surgery or long catheter procedures. The disadvantages of drug therapy are the side effects which may accompany treatment, the inconvenience of taking medication two or three times each day for many years, and the 2-8% chance of a drug making the rhythm problem worse. In addition, medical therapy may be ineffective.

Open heart surgery provides the opportunity to be cured from these rhythm problems. This is the most effective form of therapy available, since 96-99% of pathways can be eliminated. The disadvantage of the surgical approach is the 7-10 day hospitalization after surgery and the 4-10 week recovery period at home following surgery.

An additional option is that of catheter ablation or elimination of the pathway. The radiofrequency catheter ablation procedure, like surgery, eliminates the extra pathway. When this is eliminated, the circuit necessary for the rapid rhythm to occur is interrupted, and fast heart rates should not occur. For this therapy, a specially designed catheter is positioned next to the extra pathway. A form of energy is then delivered into the catheter, heating the heart tissue under the catheter tip, resulting in elimination of the pathway.

Since the majority of risk of the radiofrequency catheter ablation procedure is related to catheter insertion, the ablation is usually performed at the same time as the routine EP study. This prevents the need to expose the patient to the risk of catheter reinsertion. As a result, the decision to proceed with radio frequency ablation should be made whenever possible prior to the first EP study. This is necessary, since the sedatives used in the course of a routine study
make it impossible for a patient to discuss options during that study prior to any ablation.

In approximately 5-10% of patients, even though the extra connection appears to have been successfully eliminated during the ablation procedure, pathway function may later return. In these patients, the pathway may only be temporarily stunned and may re-awaken, allowing the rhythm disturbances to return. If this happens, a repeat ablation may be necessary.

Commonly asked questions after WPW and Slow pathway ablations

**How long does the procedure take?**

The procedure may take 1.5-3 hours to complete; it varies from person to person. Sometimes the accessory pathways or bypass tracts of a WPW ablation can be difficult to find and the procedure can last as long as 4-5 hours, but this is unusual.

Following the procedure most patients need to stay in hospital over night. You are generally discharged between 0900-1000 the next morning.

**Will my tachycardia be cured?**

The goal of this ablation is to cure but in many patients, but sometimes we are only able to reduce the frequency of episodes.

**Will I be able to stop my medications?**

If the procedure was successful, in most cases you can stop your medication.

If the medication for your tachycardia was also for your high blood pressure, you may be asked to stay on this medication.
Atrial Fibrillation

Description:
Atrial Fibrillation (AFIB) is one of the most common diseases affecting more than one in a hundred people, and as many as one in ten elderly.

The mainstay of treatment for most patients with AFIB is medications to thin the blood and control the rhythm, but alternatives to medications are proving increasingly useful. These alternatives include electrical shocks, pacemakers and AV Node ablation and more recently pulmonary vein ablation and surgical Maze Procedure.

Atrial fibrillation is a form of supraventricular tachycardia, in which the entire upper chambers of your heart, the atria, quiver due to chaotic, uncoordinated electrical activity that wanders throughout these top chambers of your heart. This results in rapid and irregular impulses (up to 300 per minute). Typically, only a few of the signals are able to pass through your AV node and then on to the ventricles. Since the ventricles are activated by the usual conduction system, they typically continue to pump blood effectively. Sometimes, if too many get through, your ventricles may beat rapidly (120 to 150 beats per minute) and irregularly. When the rate of AFIB becomes too fast your hearts efficiency is reduced, and the AFIB may make you fell tired and weak. But, as long as it is treated properly, AFIB does not normally cause serious or life-threatening problems.
Causes:

AFIB may accompany other conditions, such as high blood pressure, an overactive thyroid, or a diseased or leaky heart valve, which need treatment in their own right, and which may have caused the AFIB. In many patients, however, there may be no identifiable cause. This is known as “lone AFIB”. Lone AFIB is most common in younger patients (<60), carries a lower risk of blood clots, and is easier to eliminate than AFIB associated with other conditions.

Patterns:

Paroxysmal AFIB: Intermittent episodes of AFIB. These episodes can last from seconds, to hours, and occasionally for days, but eventually it will stop on their own.

Persistent AFIB: Episodes of AFIB that do not stop on their own, but can be stopped by a medication or a shock applied to the chest.

Permanent AFIB: Longstanding AFIB when sinus or regular rhythm cannot be restored. May be also referred to as chronic AFIB

Treatment Options:

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<th>Treatment goal</th>
<th>Effects on AFIB</th>
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<tr>
<td>Rate Control</td>
<td>Slowing the heart rate</td>
<td>None</td>
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<tr>
<td></td>
<td></td>
<td>Symptom relief</td>
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<tr>
<td>Rhythm control – anti-arrhythmic</td>
<td>Restoring your normal heart rhythm; preventing recurrences of AFIB</td>
<td>Suppressing AFIB</td>
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<tr>
<td>Anticoagulation</td>
<td>Preventing blood clots</td>
<td>None.</td>
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<td></td>
<td></td>
<td>Reduces stroke risk</td>
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<tr>
<td>Treatment</td>
<td>Goal of treatment</td>
<td>Effects on AFIB</td>
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<tr>
<td>---------------------------------</td>
<td>--------------------------------------------------------</td>
<td>-----------------------------------------------------</td>
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<tr>
<td>AV node ablation</td>
<td>Regular heartbeat, correct heart rate</td>
<td>None</td>
</tr>
<tr>
<td>Cardioversion</td>
<td>Restoring normal rhythm</td>
<td>Terminates current episode of AFIB only</td>
</tr>
<tr>
<td>Catheter Ablation Pulmonary vein ablation (PVI)</td>
<td>Restoring normal heart rhythm and preventing AFIB</td>
<td>Attempted Cure</td>
</tr>
<tr>
<td>Surgical Maze procedure</td>
<td>Restoring normal heart rhythm and preventing AFIB</td>
<td>Attempted cure</td>
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Catheter Ablation for atrial fibrillation

If medications do not control your AFIB effectively, or are not tolerated there are two types of non-drug based treatment options called AV node ablation and atrial fibrillation ablation.

AV node Ablation for AFIB:

The AV node is where the atrial and ventricular electrical systems meet. Catheters deliver energy to ablate the node. This procedure removes the electrical connection between the atria and the ventricles. The ablation slows and regularizes the heart rhythm and requires placement of a permanent pacemaker prior to the ablation.
The pacemaker keeps the ventricles working. The device produces a steady set ventricular rate, and reduces the symptoms associated with AFIB. Most people are able to stop their anti-arrhythmic medication but must remain on anticoagulants for life. The atria continue to quiver, although you may not feel it, which means there is still a risk of stroke.

Commonly asked Questions

**Will the procedure cure my AFIB?**

Although both pacemaker implantation and AV node ablation are straightforward, it does not cure AFIB. However, most patients experience much fewer palpitations, less fatigue, more tolerance for exercise, less shortness of breath and overall improvement of quality of life.

**How long does the procedure take?**

The AV node ablation takes about 1 hour.

**Is the procedure right for me?**

The procedure is irreversible, and causes lifelong need for a pacemaker. Battery depletion occurs about every 7-8 years and requires the pacemaker to be replaced.

**How long am I in the hospital?**

You are in the hospital for about 24 hours. You are usually admitted the morning of your procedure and discharged home some time the following day after your pacemaker has been checked by the pacemaker clinic.
Catheter Ablation to Cure Atrial Fibrillation/Pulmonary Vein Isolation (PVI)

AFIB often originate from the 4 pulmonary veins that carry blood from the lungs to the left atrium. AFIB can be cured in some patients with PVI. This procedure is generally reserved for patients who have significant symptoms from the AFIB and have failed medication.

With this procedure, catheters are placed in the heart and are guided to the left atrium using complex mapping equipment referred to as CARTO XP mapping system. With the help of the CARTO XP system the electrophysiologist maps the origin of the abnormal electrical signals and each of the four pulmonary veins. The CARTO computer processes the data it receives from the special Navistar catheter and creates a three-dimensional, color-coded map of heart’s rhythm disturbances that actually shows arrhythmias in real time. This allows your electrophysiologist to observe complex spatial relationships within the heart by using 3-D electro anatomical map to visualize your conduction system, color-coding and superimposing the image on to the map. We also can superimpose CT scan images on the CARTO XP map.

Catheters are used to trigger the atria and make recordings. Once the focus is found, it is destroyed by the radiofrequency energy. The procedure is most successful when there is only 1 focus. However, most patients have more than one focus. In order to eliminate these, the electrophysiologist will create lines of ablation around the pulmonary veins, where they enter from the left atrium. These prevent abnormal electrical activity from within the veins from getting into the atrium and triggering AFIB.

Commonly asked questions

*How long does the procedure take?*

AFIB ablation is a complex procedure and can take 4-8 hours to complete; it varies from person to person. Following the procedure most patients need to stay in hospital for 24-72 hours.

*Will my AFIB be cured?*
The goal of this ablation is to cure AFIB but in many patients, a second procedure may be needed.

**Will I be able to stop my medications?**

You will be followed closely by your electrophysiologist in his/her office in the weeks after your ablation. You will need to remain on anticoagulants for at least 3-4 months and if you do not have a recurrence of AFIB you may be able to stop this medication. You will probably need to stay on some of your anti-arrhythmic medications and a decision will be made in the months following your ablation when they can be stopped. This will depend on your symptoms and the recurrence of AFIB.

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**What is Atrial Flutter?**

One of the more common "atrial" arrhythmias is atrial flutter. Atrial flutter usually occurs because of changes in the atrial muscle, such as slowing of the conduction of electrical impulses through the atrium. This does not necessarily mean, however, that the patient has some other serious form of heart muscle disease. In atrial flutter, the abnormal heart rhythm originates completely within the atria. Most commonly, this takes the form of "typical" atrial flutter which occurs...
because of an electrical circuit that conducts around the heart valve between the right atrium and ventricle (tricuspid valve).

In individuals with this process, the electrical impulse travels towards the center of the heart across a narrow neck or "isthmus" of tissue between the posterior portion of this valve and the opening of the great vein (inferior vena cava) that returns blood from the legs, kidneys, abdomen, and liver. (This isthmus is the spot labelled "Site of Ablation Line" in the figure. Ablations--discussed below--are done here since this will interrupt the flutter circuit, preventing the arrhythmia from occurring). The electrical impulse travels from there toward the front of the right atrium and then the rest of the way around the tricuspid valve back to the narrow isthmus of tissue.

In other cases of atrial flutter, this same circuit is involved but the electrical impulse travels in the opposite direction. Other, less common types of atrial flutter can also develop. These "atypical" forms of atrial flutter may occur on the left side of the heart, or even around **scars in the heart from prior open heart** surgery. This atypical atrial flutter or atrial tachycardia may require non-conventional complex mapping equipment known as CARTO.

In any case, during atrial flutter the upper chambers activate anywhere from 240-320 times per minute. The activation of the rest of the upper chambers is quite organized as well.

Even though the upper chambers are beating this rapidly, the normal electrical junction box, or atrioventricular node located between the upper and lower chambers of the heart, only allows 1/3 to 1/2 of electrical impulses to reach the ventricles. Therefore the actual pulse felt at a patient’s wrist is only 100-150 pulses per minute.

Despite the slower pulse rate, patients with atrial flutter still can become quite symptomatic. As with other supraventricular arrhythmias, palpitations, shortness of breath, chest tightness, fatigue, and even dizziness can occur. Furthermore, this abnormal rhythm can last for hours or days at a time and does not respond to maneuvers like breath holding or bearing down. Because of this, most patients with this rhythm abnormality require treatment.
Treatment of Atrial Flutter

Blood Thinners
In some patients with atrial flutter, contraction of the atrial muscle is not very efficient. In such cases, blood clots can form on the inside of the atria and could even break off and travel to other parts of the body causing a stroke or blockage in an artery in a limb or abdomen. This possibility is very unlikely in patients under the age of 65 or if they have no high blood pressure, diabetes, prior stroke or blood clot history, other heart disease, abnormalities of heart pumping function, or enlargement of the upper chambers. In these individuals, no treatment to prevent strokes or blood clots is necessary. On the other hand, in the setting of these "risk factors", blood clots may occur. Because of this, patients so affected usually will require an agent such as warfarin for 4-6 weeks to "thin the blood" and decrease this blood clot risk. Whether an individual patient needs this kind of therapy before or after the procedure is an important topic of discussion with the patient’s physician. Some of the new anticoagulant agents such as dabigatran (Pradax), rivoroxiban, or apixaban may also be suggested for you to take.

Rate Control
Rapid heart rates are also a target of treatment in patients with atrial flutter. Frequently, patients will be given medications to slow down electrical impulse spread from the atria to the ventricles through the atrioventricular node. By design, drugs such as digitalis (Digoxin), beta blockers including propranolol (Inderal), metoprolol (Lopressor), atenolol (Tenormin), bisoprolol (Monocor), acebutolol (Sectral), etc.; or calcium channel blockers such as Verapamil, or diltiazem given for this purpose should decrease the heart rate from 100-150 to a slower rate. In many cases, these agents are ineffective and the heart rate remains rapid.

Eliminating Atrial Flutter
Several approaches are available to eliminate the atrial flutter without requiring a pacemaker. This can be done either with medication, or with an ablation procedure. Common medications used to terminate atrial flutter and maintain normal rhythm include propafenone,
flecainide, sotalol, amidarone, quinidine, disopyramide, ddfetilide, and dronedarone. Each of these agents has its own mechanism of action and accompanying side effects. In general, these drugs either slow down the electrical conduction to a point where it cannot continue, or they prolong the amount of time that the tissue requires to recover from a previous activation. In such a case, the tissue is not ready for any subsequent activation, and the arrhythmia stops.

These agents may be very effective in some individuals for preventing the recurrence of atrial flutter. Others may show no benefit, or may actually have an aggravation of their symptoms.

**Catheter Ablation of Atrial Flutter**

**Conventional Catheter Ablation**

Other patients may be a candidate for direct ablation of their atrial flutter. In such patients, 4 catheters are introduced into the right femoral vein and advanced into the heart. One of these catheters is positioned in the right ventricle, one near the left atrium, and several into the right atrium. These are used to stimulate the heart or make the recordings necessary to confirm that the patient has atrial flutter and identify its exact site of origin. Once this is done, radiofrequency energy can be delivered from the catheter to tissue in a strategic part of the electrical circuit or tract. This delivered energy creates a burn in the tissue that interrupts the tachycardia. When this is complete, further electrical impulses cannot travel around that circuit and the arrhythmia is eliminated. With currently used techniques, typical atrial flutters can be eliminated in 90-95% of cases. The atypical varieties are harder to cure.

It should also be noted, that there is a 20-30% chance that the atrial flutter can return. Other patients, particularly those with significant underlying heart disease, may subsequently show progression of their heart problems and can develop atrial fibrillation. This is an atrial arrhythmia in which the upper chambers beat between 300-450 beats per minute in a much more disorganized pattern. This is more likely to occur if the patient has already had an episode of atrial fibrillation, in addition to their atrial flutter. In any event, subsequent atrial fibrillation may still require treatment with anti-arrhythmic drugs.
Complex Catheter Ablation
You may have a less common types of atrial flutter known as atrial tachycardia or left sided atrial flutter. These "atypical" forms of atrial flutter may occur on the left side of the heart, or even around scars in the heart from prior open heart surgery. This atypical atrial flutter or atrial tachycardia may require non-conventional complex mapping equipment known as CARTO. The actual electrophysiology study and ablation procedure is the same as a conventional atrial flutter ablation except it involves more complex mapping equipment and can take 4-6 hours to complete a procedure. With this procedure, catheters are placed in the heart and are guided to the left atrium using complex mapping equipment referred to as CARTO XP mapping system. With the help of the CARTO XP system the electrophysiologist maps the origin of the abnormal electrical signals. The CARTO computer processes the data it receives from the special Navistar catheter and creates a three-dimensional, color-coded map of heart’s rhythm disturbances that actually shows arrhythmias in real time. This allows your electrophysiologist to observe complex spatial relationships within the heart by using 3-D electro anatomical map to visualize your conduction system, color-coding and superimposing the image on to the map. We also can superimpose CT scan images on the CARTO XP map.
Catheters are used to trigger the atria and make recordings. Once the focus is found, it is destroyed by the radiofrequency energy. The procedure is most successful when there is only 1 focus. However, most patients have more than one focus.

Commonly asked questions

*How long does the procedure take?*

If you are having a CARTO-XP ablation it is a complex procedure and can take 4-6 hours to complete; it varies from person to person. Following the procedure most patients need to stay in hospital for 24-72 hours.

*Will my Atrial flutter/tachycardia be cured?*

The goal of this ablation is to cure but in many patients, but
sometimes we are only able to reduce the frequency of episodes.

**Will I be able to stop my medications?**

You will be followed closely by your electrophysiologist in his/her office in the weeks after your ablation. You will need to remain on anticoagulants for at least 3-4 months and if you do not have a recurrence of Atrial flutter you may be able to stop this medication. You will probably need to stay on some of your anti-arrhythmic medications and a decision will be made in the months following your ablation when they can be stopped. This will depend on your symptoms and the recurrence of Atrial flutter.

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**Ventricular Tachyarrhythmias**

**Description:**
Fast rhythms beginning in your ventricles are called ventricular tachyarrhythmias or ventricular tachycardia. These often occur in individuals who have structural heart problems, usually a scar from a previous heart attack. Less frequently, ventricular tachyarrhythmias can result from rare inherited heart defects, or other causes. If you have a ventricular tachycardia, your ventricles are not activated in the usual manner by your normal conduction system. With ventricular tachycardia, there is some organized ventricular activity, but it is very rapid. Some ventricular tachycardias can effectively pump blood and maintain a blood pressure, but others do not, resulting in fainting or sudden cardiac death. Ventricular tachycardia can also at times change into ventricular fibrillation (Figure 4).
As in atrial fibrillation, the abnormal rhythm is due to chaotic electrical activity, which causes your heart to quiver instead of contract. In ventricular fibrillation, the abnormal electrical activity is now in the lower (pumping) chambers of your heart. Although medications can be used to treat ventricular tachycardia, the only therapy for ventricular fibrillation is defibrillation (an electric shock) to stop this life-threatening rhythm. If not treated immediately, this abnormal rhythm results in death within minutes.

**Treatment Options:**

**Medications**

Until the mid-1980s ventricular tachycardias have been treated mainly with medications. Since these heart rhythms are life-threatening, testing is sometime done in a hospital setting to determine the effectiveness of the medication. This testing involves the electrophysiology study, as previously described. During an electrophysiology study, the electrical impulses within the heart are recorded. The physician will try to stimulate the heart to beat abnormally, and determine whether the heart is susceptible to abnormal heart rhythms. If this happens, you may be started on a heart rhythm medication.

**Defibrillator Implant**

Another way to treat ventricular tachyarrhythmias is with a device called an implantable cardioverter defibrillator (ICD). ICDs are small devices that are implanted under the skin below the collarbone, similar to
pacemakers. The ICD implant procedure usually takes about one hour and you may be discharged from the hospital after one or two days. The ICD continuously monitors the heart’s rhythm. If your heart rate becomes too slow, then like a pacemaker, the ICD is capable of pacing the heart to prevent pauses. Should your heart beat too fast, the ICD will try to stop the ventricular tachycardia, by delivering bursts of energy to restore a normal rhythm. In clinical studies, ICDS have been shown to be 98% effective in stopping life-threatening rhythms.

Recent studies have shown that ICDs prolong life compared with conventional medication therapy in patients who are at high risk of dangerous ventricular tachyarrhythmias. One recent study found that people who received ICDs had a 39% reduction in deaths in the first year compared with people who received heart rhythm medications.

The best treatment for ventricular tachyarrhythmias depends on your history of previous heart rhythm problems and on your underlying heart disease.

**Catheter Ablation of Ventricular tachycardia**

If your ventricular tachycardia meets certain conditions, radiofrequency ablation may be done as a form of treatment.

**Catheter Ablation of Ventricular Tachycardia**

**Conventional Catheter Ablation**

Candidates for direct ablation of their ventricular tachycardia will have 4 catheters are introduced into the right femoral vein and advanced into the heart. One of these catheters is positioned in the right ventricle, one near the left atrium, one near the AV node and one may also be placed into you left ventricle depending on which side of you heart your ventricular tachycardia originates from. These are used to stimulate the heart or make the recordings necessary to confirm that the patient has Ventricular tachycardia and identify its exact site of origin. Once this is done radiofrequency energy can be delivered from the catheter to tissue in a strategic part of the electrical circuit or tract. This delivered energy creates a burn in the tissue that interrupts the tachycardia. When this is complete, further electrical impulses cannot travel around that circuit and the arrhythmia is eliminated. With currently used techniques, some ventricular tachycardias can be eliminated. The atypical varieties are harder to cure.
It should also be noted, that there is a 30-40% chance that the ventricular tachycardia can return. Other patients, particularly those with significant underlying heart disease, may subsequently show progression of their heart problems and can develop ventricular tachycardia from other foci.

**Complex Catheter Ablation**

Many ventricular tachycardia are very difficult to ablate using conventional mapping equipment and may require either the CARTO-XP mapping system or the Endocardial Solutions (ESI) mapping system. The actual electrophysiology study and ablation procedure is the same as a conventional Ventricular tachycardia ablation except it involves more complex mapping equipment and can take 4-6 hours to complete a procedure. With this procedure, catheters are placed in the heart and are guided to the right or left ventricle using complex mapping equipment referred to as CARTO XP mapping system or ESI mapping system. Your electrophysiologist will decide which of these systems are best suited to map your tachycardia.

With the help of the CARTO XP system the electrophysiologist maps the origin of the abnormal electrical signals. The CARTO computer processes the data it receives from the special Navistar catheter and creates a three-dimensional, color-coded map of heart’s rhythm disturbances that actually shows arrhythmias in real time. This allows your electrophysiologist to observe complex spatial relationships within the heart by using 3-D electro anatomical map to visualize your conduction system, color-coding and superimposing the image on to the map. We also can superimpose CT scan images on the CARTO XP map.

ESI differs from CARTO-XP in that the special Ensite array or Ensite NavX catheters that are used for this system do not touch the sides of the heart chamber; the procedure is therefore called “noncontact” mapping.

The catheter’s “balloon” acts like a miniature radio antenna, receiving signals from all around the heart chamber and relaying them to a special computer. The computer quickly processes the signals and displays the recorded information in a three-dimensional graphical display. By viewing electrical activity in a three-dimensional format, your doctor may be able to more quickly and accurately locate your
problem areas. When the arrhythmia is located, the electrical map of the heart will help your physician guide an ablation catheter to the site of the arrhythmia for treatment.

Catheters are used to trigger the ventricle and make recordings. Once the focus is found, it is destroyed by the radiofrequency energy. The procedure is most successful when there is only 1 focus. However, many patients have more than one focus.

**Commonly asked questions**

*How long does the procedure take?*

If you are having a CARTO-XP or ESI mapping/ablation it is a complex procedure and can take 4-6 hours to complete; it varies from person to person. Following the procedure most patients need to stay in hospital for 24-72 hours.

*Will my ventricular tachycardia be cured?*

The goal of this ablation is to cure but in many patients, but sometimes we are only able to reduce the frequency of episodes.

*Will I be able to stop my medications?*

You will be followed closely by your electrophysiologist in his/her office in the weeks after your ablation. You may need to stay on your medication initially following your ablation for 4-6 weeks. A decision will be made in the months following your ablation when they can be stopped. This will depend on your symptoms and the recurrence of ventricular tachycardia.
Patient Education Websites:

http://www.hrsonline.org/PatientInfo/


http://www.heart.org/HEARTORG/search/searchResults.jsp?_dyncharset=ISO-8859-1&q=ablation