What is Atrial Fibrillation?

Atrial Fibrillation (AF) is a very common heart rhythm disorder where the heartbeat is irregular and rapid. It originates in the hearts upper chambers, the atria. The incidence of AF increase dramatically as people age, with about 5% of people over the age of 70 affected. AF may be persistent (i.e. lasting many days or requiring chemical or electrical conversion to restore normal, sinus rhythm) or occur in spells lasting minutes to hours/days (paroxysmal).
Symptoms associated with atrial fibrillation vary widely from patient to patient & range from mild to severe. Complaints include palpitations (an unpleasant awareness of the heart beat), weakness, dizziness, chest pain and shortness of breath.

**Concerns with Atrial Fibrillation**

The only 2 significant medical concerns (i.e.- those which can affect patient prognosis) are *uncontrolled heart rates* (either too slow or too fast) and the *risk of stroke*. We always attempt to alleviate unpleasant patient symptoms, but the degree of symptoms does not affect the prognosis.

The two approaches to address these concerns are to **control the rate of the atrial fibrillation or to control the arrhythmia itself**. The risk of a stroke is actually independent of which method of treatment is used.

*Rate control* means that the fibrillation is allowed to happen, but the rate that the heart beats is controlled with medications or a pacemaker. If this adequately controls a patient’s symptoms, then attempts at converting the rhythm back to normal may not be necessary.

The other approach is *rhythm control*. This therapy attempts to maintain normal rhythm of the heart, and usually this controls the rate as well as the symptoms. The usual method of rhythm control is to use anti-arrhythmic medication. These are either taken on a daily basis for prevention, or in some cases can be used just when the heart goes out of rhythm to help restore the normal rhythm more quickly.
As mentioned above, the risk of having a stroke from atrial fibrillation is actually unrelated to which therapeutic approach is taken. In other words, elimination of the atrial fibrillation with medications or ablation may not decrease stroke risk. Stroke risks with atrial fibrillation include:

- Age > 65 years
- Significant heart disease
- High blood pressure
- Prior stroke
- Diabetes mellitus

Patients at high risk for stroke are usually (not always) treated with the blood thinner coumadin (warfarin). Newer blood thinners will become available over the next few years. Patients with lower stroke risks can do well with aspirin. Young patients with no stroke risk factors (other than atrial fibrillation) can do well even without aspirin.

**What is Catheter Ablation for Atrial Fibrillation?**

An ablation is a procedure designed to use energy to disrupt or eliminate the faulty electrical pathways that cause abnormal heart rhythms. The catheter ablation procedure for atrial fibrillation is restricted to those individuals in whom it is felt that the triggers for atrial fibrillation are likely to reside in the left atrium and pulmonary veins. The pulmonary veins are the vessels that bring blood back from the lungs into the left atrium of the heart. Normally there is no electrical activity in these veins, but if left atrial tissue extends into the veins (it is not unusual for atrial tissue to extend into the veins in an irregular fashion for up to 2-4 cm) and the veins develop some electrical activity, rapid firing of cells in the veins may occur and these impulses may conduct to the atrium and start atrial fibrillation.

There are 4 pulmonary veins in the heart. Any one or several of the veins could contain the cells that trigger the fibrillation. Therefore, it is usually necessary to electrically isolate all of the pulmonary veins as well as other sites in the left and right atria with abnormal electrical activity, which could be triggering or perpetuating atrial fibrillation to get a good chance at control of the arrhythmia.
In this drawing, EP mapping catheters are seen crossing the wall between the right atrium to the left upper and right upper pulmonary veins to allow measurement of electrical activity within the veins.

The Procedure

You will be admitted to our Cardiac Short Stay Unit on level 3 of the D&T building at the Royal Jubilee Hospital. The ablation will take place in a special room called the EP (Electrophysiology) Lab. Often the catheter ablation procedure is done as a “day procedure” although occasionally patients are admitted to hospital for observation pre- and post-procedure.

You must have an empty stomach. Do not eat or drink anything after midnight the night before your procedure, unless specifically instructed otherwise. If you must take medications, drink only small sips of water to help you swallow your pills.

Wear comfortable clothes; leave all jewellery and valuables at home.

A nurse will prepare you for the procedure. You will have an IV (intravenous) line started so that you can receive medications and fluids during the procedure.

Your skin will be prepared and certain areas may need to be shaved to allow monitoring pads to adhere.

Once you are in the EP Lab a nurse will remain with you throughout the procedure. You will be connected to several monitors that allow us to check your heart’s rhythm and your body’s response to any arrhythmias. The procedure generally lasts 3-4 hours and during this time intravenous sedation is used for comfort.

Using local anaesthetic, intravenous sheaths are placed in the femoral vein (the large vein running up the leg) at the top, front of the
leg just below the groin crease. Occasionally it is necessary to place one of the sheaths in the vein in the neck as well. It is important that you remain still and if you are uncomfortable or need anything please let your nurse know. Through the intravenous sheaths temporary EP catheters (small, flexible wires) are advanced to the heart under X-Ray guidance. **Since X-Ray is required for the procedure you must alert the physician beforehand if you think you may be pregnant.** As well, because the placement of the intravenous sheaths and catheters could cause some bleeding we require patients to be off coumadin (warfarin) for about 3 days before the procedure. Our office should give you instructions about this beforehand. **If you have not heard from us it is important that you call the office for instructions on exactly when to stop coumadin.** In some instances, if it is felt that being off coumadin for too long is risky we may prescribe a subcutaneous anti-coagulant (for example, the low molecular weight heparin called Tinzaparin) to be taken for a few days just before and/or just after the ablation procedure.

There is minimal to no discomfort with placement of the catheters up the vein and to the heart. The left atrium is then extensively mapped to locate ablation sites within the heart. Common sites for ablation include the mouth of the pulmonary veins (the veins that drain the blood back from the lungs to the left heart chambers) to electrically “isolate” the veins from the heart since it is known that electrical firing from inside the pulmonary veins are usually the triggers for atrial fibrillation. Several other sites within the right and left atria are also targeted for ablation.

The ablation burns are delivered from the tip of one of the EP catheters using radiofrequency energy. Radiofrequency energy is commonly used by surgeons with their electronic scalpel (cautery). The ablation “burns” are each only a couple millimetres in diameter and depth and thus up to 10-15 burns are necessary to “isolate” each of the pulmonary veins. Additional ablation burns are placed in other locations within the left and right
atria. The exact location for these burns depends on the type of atrial fibrillation and the type of signals detected during the electrical mapping of the atria. Unfortunately if even small gaps are left in the burn lines the triggering impulses can “sneak through” and cause atrial fibrillation.

You may feel some discomfort or a burning sensation in your chest during the procedure – usually due to the ablation burns in a number of tender spots in the heart. We usually can predict these tender spots though and adequate sedation/pain medication is given. It is very important that you stay quiet, keep very still and avoid taking deep breaths to avoid causing small movements of the ablation catheter during your procedure. Tell your nurse or doctor about any discomfort so that they can give you more medication to allow more sedation and pain control.

At the end of the procedure all of the catheters and sheaths will be removed and you will return to the Cardiac Short Stay Unit for close monitoring. To prevent bleeding at the sheath site in the groin, patients must lie flat with the leg straight for approximately 3 hours. Keep your leg as still as possible during this time to prevent bleeding. Occasionally you may feel a burning sensation in the chest for a few days after the ablation procedure. This is usually caused by some irritation to the lining of the heart (the pericardium) from the catheters and the ablation burns. An anti-inflammatory medication such as ibuprofen or a simple painkiller like Tylenol can be effective at settling the burning pain. It is not usual that you should need this for more than a few days.

**Outcomes of the Ablation Procedure**

The best way to determine whether the ablation procedure has been successful is by assessing clinical outcome (i.e. whether or not atrial fibrillation is better after ablation than before). There are a number of ways to define a successful ablation (pulmonary vein isolation) procedure. They include:

- No further atrial fibrillation
- Less frequent or less prolonged atrial fibrillation
Atrial fibrillation now responds to medical therapy

It is not uncommon for atrial fibrillation to flare up post procedure for up to 8 weeks. This is likely just a reaction to the procedure and, as healing occurs, the arrhythmia settles. Occasionally medication is needed for symptomatic relief over the first few weeks but can usually be stopped subsequently.

As defined by the criteria above, the atrial fibrillation catheter ablation procedure has a success rate of 60-70%. For those with an unsuccessful procedure a second (and occasionally a third) procedure is needed to find and ablate the gaps in the burn line around the pulmonary vein(s) and in the left and right atria. Current success rates, with more than one procedure, approximates 80-85%.

Potential Complications:

Stroke—Since the ablation procedure is being done on the left side of the heart, and blood that leaves the left side of the heart goes out to the body (including the brain), a blood clot forming at the ablation site, on the EP catheter or dislodged from the heart by the catheter and travelling to the brain could cause a stroke. Left heart procedures have been done for decades and the quoted stroke risk with most left heart procedures, such as coronary angiography, is 1/1000. Since the ablation procedure involves more involved work in the left atrium this risk may be closer to 1/500. To decrease this risk all patients coming for the procedure are fully anti-coagulated with coumadin (to keep INR >1.9) for at least 1-2 months pre-procedure then 1-2 months post-procedure. We generally discontinue coumadin 2-3 days before the ablation procedure to lessen the risk of serious bleeding at the time of catheter placement. However, during the procedure, heparin (an intravenous anti-coagulant) is administered and coumadin is restarted post procedure. For patients suspected to have blood clots in the left atrium before the procedure a Transesophageal Echocardiogram might be considered necessary and, as mentioned above, you might be sent home on subcutaneous a few days treatment with Tinzaparin since the effects of coumadin are delayed for 3-4 days.
Cardiac perforation- The left atrial wall and pulmonary veins are quite thin, measuring only a couple of millimetres in thickness. It is possible that one of the EP Catheters in the heart could perforate the heart. Usually this simply heals over without any untoward effects. Very infrequently blood from the heart could seep out through a perforation filling the space around the heart, and thus constricting the heart, impairing heart function. If so, a needle would be inserted through the chest wall to remove this blood and a drain would likely be left in place for a day or two. Very rarely an operation to repair the perforation might be needed.

Pulmonary stenosis- Since the pulmonary veins are quite small (10-15mm diameter where they enter the left atrium), it is possible to damage the pulmonary vein with the ablation procedure. The vein could develop an irreversible constriction. If only one vein is involved there would likely not be any associated symptoms, however, shortness of breath and cough are possible as is the rare complication of pulmonary hypertension (high pressures in the lung on that side), which presents with a cough sometimes productive of blood.

Damage to other structures in and around the heart- With any ablation procedure other structures such as heart valves, coronary arteries, phrenic nerve (the nerve supplying the diaphragm), inferior vena cavae or the AV node can very rarely be damaged. There have currently been 5 reports worldwide of atrial-esophageal fistula – which is a hole, or connection, developing between the back of the left atrium and the esophagus (or swallowing tube), which is situated directly behind the left atrium. While this complication is exceedingly rare it is very serious and could be fatal. We have modified our procedure to decrease the risk of this complication, but it does remain a remote risk.

We estimate the risk of one of the significant complications occurring with the pulmonary vein isolation catheter ablation procedure to be between 0.5-2 %.