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Your Premier Information Resource for Lone Atrial Fibrillation!

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It is estimated that about 38% of afibbers undergoing radiofrequency catheter ablation for atrial fibrillation (AF) experience recurrence of arrhythmias (AF, atrial flutter or left atrial tachycardia) within the first 3 months following the procedure (early recurrence). Experiencing early recurrences of atrial tachyarrhythmias (ERAT) does not necessarily indicate failure, since about 50% of those having ERAT go on to experience long-term freedom from atrial arrhythmias. A team of Canadian EPs suggests that ERAT may represent a transient and potentially reversible phenomenon related to the proarrhythmic effect of ablation – specifically inflammation and autonomic nervous system modification. This supports the use of the post-ablation care protocol outlined at

www.afibbers.org/resources/postablationcare.pdf. The EPs conclude that advanced age, hypertension, persistent or permanent AF, left atrial enlargement, decreased left ventricular ejection fraction, and incomplete pulmonary vein isolation are important predictors of ERAT.

Also in this issue we report on a study of ablation outcomes in afibbers older than 80 years concluding that age is no obstacle to undergoing a safe and successful RF ablation, another study reports that nurse-led care of AF patients provides superior results when compared to usual care by a cardiologist, Australian researchers report that several electrophysiologic measurements in the pulmonary veins in lone afibbers are substantially different from those found in patients who have never experienced AF.

Last, but certainly not least, I have decided to make “The AFIB Report” a bimonthly publication starting with the upcoming June/July issue. My workload has steadily been increasing to the point of it being excessive and I need some time off “to smell the roses”!! The yearly subscription fee for the 6 issues will be reduced to \$29/year. Current subscribers will have their subscriptions extended to receive the 10 issues originally paid for.

And finally, if you need to restock your supplements, please remember that by ordering through my on-line vitamin store you will be helping to defray the cost of maintaining the web site and bulletin board. You can find the store at <http://www.afibbers.org/vitamins.htm> - your continuing support is very much appreciated.

Wishing you good health and lots of NSR,

Hans

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Role of nurses in the management of AF

MAASTRICHT, THE NETHERLANDS. Atrial fibrillation (F) particularly when combined with comorbid conditions such as hypertension, heart failure, diabetes and previous stroke/TIA is a complex condition. AF is now epidemic and is becoming an extremely costly public health problem. A team of Dutch cardiologists now report that care and follow-up provided by nurses are superior to the usual care provided by cardiologists

when it comes to preventing AF-associated hospitalization and death.

Their study involved 712 AF patients (average age of 67 years, 59% male) who were randomly assigned to nurse-led care or usual care. The majority (55%) of the study participants had paroxysmal AF, while the remaining had either persistent (16%) or permanent (29%) AF. In 83% of cases AF episodes were symptomatic. The patients were by no means lone afibbers with 53% having hypertension, 13% having experienced a prior stroke or TIA, 17% having coronary artery disease or heart failure, and 14% having diabetes. About half the patients (49%) had been prescribed a beta-blocker, while 14% were on digoxin. Most study participants (72%) had one or more risk factors for ischemic stroke and 89% were prescribed warfarin (57%) or aspirin (32%).

At the start of the study all patients underwent laboratory testing, electrocardiography, Holter monitoring, and echocardiography. Members of the usual care group then saw a cardiologist for a 20-minute consultation during which their test results were discussed and medication prescribed as deemed necessary by the cardiologist. Ten-minute follow-up visits were scheduled for every 6 months thereafter for at least a year.

The first visit for patients in the nurse-led group was scheduled to last 30 minutes. During it, the nurse specialist took the patient's history and informed them about the general nature of AF, its symptoms

and possible complications, the results of the diagnostic tests, and discussed applicable treatment options. The patient's data was then entered into the *CardioConsult AF* computer program. The program calculates a patient profile based on symptoms, type of AF and stroke risk (CHADS₂ score), and then proposes the most appropriate approach to managing the condition in accordance with the 2006 American and European guidelines for the management of atrial fibrillation. The nurse specialist discussed the protocol with the cardiologist before implementation. Half-hour follow-up visits were scheduled for every 6 months thereafter for at least a year.

During follow-up 48 patients (13.5%) in the nurse-led group were hospitalized for AF-related problems as compared to 74 patients (20.8%) in the group receiving usual care by a cardiologist. Four patients (1.1%) in the nurse-led group died from cardiovascular causes as compared to 14 patients (3.9%) in the usual care group. The incidence of stroke was 0.8% in the nurse-led group and 1.4% in the usual care group – far lower than the 5%/year risk often quoted for AF patients.

The authors of the study conclude “*that like in the aviation industry, modern medicine benefits from protocolized procedures and the presence of a co-pilot (nurse specialist), thereby preventing medical accidents.*”

Hendriks, JML, et al. Nurse-led care vs. usual care for patients with atrial fibrillation. European Heart Journal, March 27, 2012 [Epub ahead of print]

Ablation outcome in octogenarians

AUSTIN, TEXAS. As the population ages, the question naturally arises, is radiofrequency catheter ablation (RFCA) for the purpose of curing atrial fibrillation (AF) safe and effective in older afibbers, in particular, those over the age of 80 years? A team of experienced electrophysiologists now answer this question.

Their study involved 2754 consecutive AF patients who had undergone one or more ablations during

the period 2008 to 2011 at St. David's Medical Center, Scripps Clinic, California Pacific Medical Center or University of Foggia (all headed by Dr. Andrea Natale). One hundred and three (103) of these patients were older than 80 years (average age of 85 years with 4 patients being older than 90 years). The average age of the remaining 2651 patients was 62 years with 72% being male (only 59% were male in the older group). Other pertinent characteristics of the two groups were:

| | Older Group | Younger Group |
|--------------------------------------|-------------|---------------|
| Paroxysmal AF | 25% | 27% |
| Persistent AF | 42% | 39% |
| Permanent AF | 33% | 34% |
| Hypertension | 48% | 37% |
| Coronary artery disease | 15% | 11% |
| Heart failure | 17% | 10% |
| CHADS ₂ score – 0 | 0% | 38% |
| CHADS ₂ score – 1 | 34% | 42% |
| CHADS ₂ score – 2 or more | 66% | 20% |

The RFCA was carried out under general anesthesia in all patients with an esophageal probe used to monitor esophageal temperature during ablation in order to avoid creating an atri-esophageal fistula. Patients with paroxysmal AF underwent pulmonary vein antrum isolation and isolation of the superior vena cava. In patients with persistent and permanent (long-standing persistent) AF, the electrical isolation of the pulmonary veins was extended to the entire posterior wall down to the coronary sinus and the left side of the septum. Ablation of complex fractionated electrograms in the left atrium and in the coronary sinus was also performed. Finally, a 15 to 20 minute challenge with high-dose isoproterenol was performed to check for lesion gaps and any such gaps were re-ablated.

Total procedure, fluoroscopy, and RF times did not differ between the two groups; however, triggers located outside the pulmonary veins were significantly more common (62%) in the older group than in the younger group. Non-pulmonary triggers were significantly more common among persistent and permanent afibbers, but their percentage in the older group (92%) was not significantly higher than in the younger group (87%).

Oral anticoagulant therapy with adjusted-dose warfarin was continued for up to 6 months to maintain the INR between 2 and 3. After this period, warfarin was discontinued, regardless of the CHADS₂ score, if patients did not undergo isolation of the left atrial appendage and did not experience any recurrence of atrial tachyarrhythmias, severe pulmonary vein stenosis, or severe left atrial mechanical dysfunction.

After a mean follow-up of 18 months, 69% of the octogenarians remained free from AF recurrence without the use of antiarrhythmics. This single procedure success rate was not significantly

different from the 71% complete success rate observed in the younger group. A total of 21 of 32 octogenarians with AF recurrence after the first procedure underwent a repeat procedure after a failed challenge with antiarrhythmic drugs. After a mean follow-up of 9 months, 90% of the repeat ablates were in normal sinus rhythm, bringing the complete success rate to 87% after an average 1.2 ablations. The final success rate in the younger group was 85%.

Warfarin was discontinued in 49 of 71 octogenarians (69%) achieving long-term freedom from AF recurrence after a single procedure, corresponding to 48% of the entire elderly population. The reason for continuing warfarin in the remaining 22 patients (31%) was left atrial appendage isolation during the index procedure. No patients died and none experienced a stroke/TIA during the procedure itself or during the follow-up period.

Santangeli, P, Natale, A, et al. Catheter ablation of atrial fibrillation in octogenarians: safety of outcomes. Journal of Cardiovascular Electrophysiology, April 11, 2012 [Epub ahead of print]

Kim, MH. Catheter ablation of atrial fibrillation in octogenarians: the right "medicine"? Journal of Cardiovascular Electrophysiology, April 11, 2012 [Epub ahead of print]

Editor's comment: It is indeed encouraging that age is no obstacle to having a safe and successful radiofrequency catheter ablation. A final average success rate of 87% after an average 1.2 ablations is also most impressive, particularly when considering that 75% of the older patients had persistent or permanent AF. However, when considering the results it should be kept in mind that they were obtained by the most skilled group of EPs in the United States and are unlikely to be repeatable at "your neighbourhood" ablation facility.

Atrial fibrillation and metabolic syndrome

AUSTIN, TEXAS. Metabolic syndrome (MS) combines a cluster of cardiovascular risk factors including obesity, hypertension, diabetes, and dyslipidemia as indicated by a HDL (high-density lipoprotein) level of less than 40 mg/dL for men and less than 50 mg/dL for women and a serum triglyceride level of 150 mg/dL or higher. Both MS and atrial fibrillation (AF) involve systemic inflammation, so it is not surprising that the two conditions often coexist. It is also not surprising that MS and AF both are associated with an often vastly diminished quality of life (QoL). A team of electrophysiologists from the USA, China, and Italy set out to determine the impact of radiofrequency catheter ablation on AF recurrence and QoL in AF patients with and without comorbid MS.

The study involved 485 patients with AF and MS (average age of 64 years, 77% men, 32% paroxysmal) and 1010 AF patients without MS (average age of 62 years, 72% men, 28% paroxysmal). Both groups had elevated levels of the inflammation marker C-reactive protein (CRP) and white blood cells (WBC), with the levels being significantly higher in the MS group. As expected, hypertension, diabetes, obesity and dyslipidemia were more prevalent in the MS group, as was the incidence of coronary artery disease, heart failure and left atrium enlargement.

The Medical Outcomes Study SF-36 Health Survey was used to assess QoL at baseline and 12 months after ablation. The SF-36 Survey measures two composite scores – the **mental health component summary (MCS)** covering such aspects as vitality, social functioning, role limitations due to emotional problems and mental health, and the **physical health component summary (PCS)** which includes such aspects as physical functioning, role limitations due to physical health, bodily pain and general well-being.

All study participants underwent a single standard pulmonary vein isolation procedure with additional lesions as required. After a 21-month follow-up, 39% of the members of the AF/MS group had experienced arrhythmia recurrence as compared to 32% in the AF only group. The main predictors of

AF recurrence in patients with non-paroxysmal AF (persistent and permanent) were the presence of MS (a 42% relative risk increase), female sex (a 28% relative risk increase), elevated CRP (an 87% relative risk increase if over 0.9 mg/dL), and an elevated WBC count. The above factors did not predict risk of recurrence in patients with paroxysmal AF. The main procedure-related complication was pericardial effusion, which occurred in 11 patients (0.7%).

Quality of Life scores were significantly lower at baseline for the AF/MS group than for the AF alone group. However, both the MCS and PCS scores improved significantly in the AF/MS group following a successful ablation. MCS increased by 5.7 points and PCS increased by 9.1 points. In the AF alone group only MCS improved (by 4.6 points).

The authors of the study speculate that the poorer outcome for AF/MS patients is related to increased inflammation and increased structural remodelling as expressed by left atrium enlargement and increased atrial fibrosis. Fibrosis leads to the separation of myocytes (heart cells) from one another, which significantly impairs the transmission of electrical signals at the cellular level and results in chaotic atrial conduction.

Mohanty, S, Natale, A, et al. Impact of metabolic syndrome on procedural outcomes in patients with atrial fibrillation undergoing catheter ablation. Journal of the American College of Cardiology, Vol. 59, No. 14, April 3, 2012, pp. 1295-301

Asirvatham, SJ and Jiao, Z. What causes atrial fibrillation and why do we fail with ablation? Journal of the American College of Cardiology, Vol. 59, No. 14, April 3, 2012, pp. 1302-03

Editor's comment: Apart from confirming that a combination of AF and MS makes for a pretty miserable quality of life, this study once again concludes the negative consequences of going into an ablation with an elevated level of systemic inflammation. Inflammation can be reliably reduced by supplementation with such natural anti-inflammatories as vitamin C, fish oil, *Zyflamend*, curcumin, beta-sitosterol and *Boswellia*.

Pulmonary vein properties in lone atrial fibrillation

ADELAIDE, AUSTRALIA. In April 2009 Professor Prash Sanders and colleagues at the Royal Adelaide Hospital published a landmark study concerning the electroanatomic properties of the left atrium in patients with lone atrial fibrillation (LAF). Before getting into details of their study it is, however, necessary to ensure that the reader has a basic understanding of the parameters governing normal as well as abnormal heart rhythms (arrhythmias).

HEART RHYTHM 101

The membrane (sarcolemma) of a resting heart cell (myocyte) is polarized – that is, the inside (intracellular space) of the cell (cytoplasm) is negatively charged in respect to the outside environment (extracellular space). Responding to an impulse from the sinoatrial (SA) node (the heart's natural pacemaker controlled by the autonomic nervous system) the myocytes depolarize resulting in contraction of the heart muscle. The *depolarization* is caused by a rapid influx of positive sodium (Na^+) ions followed by a slower influx of calcium ions (Ca^{++}). During depolarization the outward leakage of potassium ions (K^+) is restricted. Atrial depolarization shows up as a P wave on an electrocardiogram (ECG) while ventricular depolarization is identified as the QRS complex – that is, the time period on the ECG during which the ventricles depolarize (contract). The P wave is absent during atrial fibrillation. The time interval between the start of the P wave and the beginning of the QRS complex is a vulnerable period for AF initiation.

Depolarization is followed by *repolarization* (recovery). During this phase, an outflow of K^+ ions is followed by a period during which the intracellular concentrations of K^+ and Na^+ in the myocytes are restored to their resting potential through the action of Na^+/K^+ ATPase pumps “powered” by magnesium. Magnesium ions (Mg^{++}) also play an important role during this phase by slowing down the outward (from intracellular space to extracellular space) flow of potassium ions. At the risk of oversimplification, one could say that while Na^+ and Ca^{++} are “excitatory” ions K^+ and Mg^{++} ions are “calming”. Thus it is not surprising that a deficiency of K^+ and Mg^{++} facilitate atrial fibrillation. Repolarization is identified on the ECG as the time period from the end of ventricular depolarization to the peak of the T wave (ST segment).

The *atrioventricular (AV) node* is a specialized conglomeration of myocytes that acts as the speed controller for ventricular contractions (depolarization) just as the SA node does for atrial contractions. Normally, the AV node receives its “instructions” directly from the SA node through a well-defined “wiring circuit”; however, during atrial fibrillation the AV node is bombarded by impulses from rogue atrial cells which, if they are not filtered out by the AV node will cause the rapid, irregular ventricular contractions characteristic of atrial fibrillation.

The period from the start of the QRS complex to the peak of the T wave is of particular interest when it comes to atrial fibrillation. During this period (the *effective refractory period or ERP*) myocyte depolarization cannot be triggered by stimulus originating from rogue atrial cells thus preventing AF from being initiated. However, atrial fibrillation can be triggered during the last half of the T wave (*relative refractory period or RRP*) making it highly desirable that the ERP is as long as possible and the RRP as short as possible. Several medications aim to exploit this fact by acting to extend the ERP so that the RRP (the vulnerable period) becomes as short as possible. This is particularly important in the case of the AV node as during the

ERP the node cannot be stimulated and thus in essence filters out the erratic atrial impulses.

The speed with which an electrical impulse moves across the atrium (normally directly from the SA node to the AV node) is called the *conduction velocity* and is a measure of the effectiveness of cell-to-cell depolarization. It is measured in millimeter/millisecond (mm/ms) or in meter/second (m/s). Sympathetic (adrenergic) stimulation increases conduction velocity while parasympathetic (vagal) stimulation reduces it.

As a result of this study, we now know that lone, paroxysmal afibbers have an abnormal atrial substrate, and that this abnormality is what promotes the progression of AF. In a follow-up to the 2009 study, the Adelaide team now reports the results of a study designed to elucidate the electroanatomic properties of the pulmonary veins (PVs) which, as discovered by Professor Michel Haissaguerre in 1998, are the prime source of the “misfirings” initiating the vast majority of AF episodes.

The electrophysiology study (carried out as part of a scheduled ablation) involved 21 patients with paroxysmal AF, 18 with persistent AF, and 15 age-matched controls with supraventricular tachycardia (left-sided accessory pathways). The average age of the participants was 58 years and 78% were male. The researchers made the following observations.

- The local voltage in the PVs (defined as the amplitude of the peak positive to peak negative deflections of the local electrograms) during constant pacing at 100 bpm (600 ms cycle length) was significantly lower in AF patients than in controls, and the percentage of low voltage readings was significantly higher in afibbers than in controls, with the highest percentage found in persistent afibbers. This finding is consistent with the presence of fibrosis within the PVs.
- The PV muscle sleeves (an extension of the left atrial tissue into the PVs) were shorter among AF patients than among controls.
- Conduction velocity was significantly slower among persistent afibbers than among paroxysmal ones and, in both cases, slower than that observed for controls. This finding is also consistent with the presence of fibrosis in the PVs.
- In the group of paroxysmal afibbers, the ERPs in the left and right superior PVs were significantly shorter than the ERPs measured in the posterior left atrium, the left atrial appendage and the distal coronary sinus (CSd), and also shorter than in the control group.
- In the group of persistent afibbers, the ERPs measured in the left and right superior PVs were significantly shorter than the ERPs measured in the CSd and also shorter than the average ERP in the control group.
- In contrast to the findings for the PVs, the ERPs in the posterior left atrium and left atrial appendage were prolonged in paroxysmal afibbers compared with controls, while persistent afibbers had shorter ERPs than both the control group and the paroxysmal group.
- Complex signals (defined as those with 3 or more deflections of more than 50 ms duration, or those with 2 separate deflections separated by more than 30 ms) were significantly more prevalent among persistent afibbers than among paroxysmal, and both had a higher percentage of these signals than did the control group.

The authors of the study conclude that paroxysmal and persistent afibbers demonstrate electrical and electroanatomic remodelling of the PVs compared to controls without prior AF. Some of the changes were more marked in patients with persistent AF.

Teh, AW, et al. Electroanatomic properties of the pulmonary veins: slowed conduction, low voltage and altered refractoriness in AF patients. Journal of Cardiovascular Electrophysiology, Vol. 22, October 2011, pp. 1083-91

Editor’s comment: This study adds valuable information to our knowledge of the mechanism underlying atrial fibrillation and explains the major role played by the pulmonary veins in the initiation of AF episodes. It also explains why electrical isolation of the pulmonary veins through catheter ablation is an effective means of eliminating AF, especially in the case of paroxysmal AF.

Avoid hospitals on weekends

LITTLE ROCK, ARKANSAS. Several studies have shown that patients admitted to hospital on a weekend tend to have a poorer outcome. In 2007 William Kostis and colleagues reported that patients admitted to hospital on a weekend with a heart attack (myocardial infarction) were less likely to be treated promptly with the appropriate invasive procedure and, as a result, experienced significantly higher mortality. The average mortality on the day following admission on weekends was 3.3% vs. 2.7% if admitted during the week.[1]

Now medical doctors associated with the Central Arkansas Veterans Healthcare System report that the outcome for patients admitted on a weekend (Friday night to Sunday night) with atrial fibrillation (AF) is significantly poorer than for AF patients admitted during the week. Their study included 86,497 patients who had been diagnosed from a US hospital during 2008 (data obtained from the Nationwide Inpatient Sample 2008 database). They

observed that the use of cardioversion was far less common on weekends than on weekdays (7.9% vs. 16.2%) and was often delayed. Also, after adjusting for patient and hospital characteristics and comorbid disease severity, the odds of an AF patient dying in the hospital if admitted on a weekend was 24% (relative) higher than if admitted on a weekday (1.1% vs. 0.9%). The mortality rate among black Americans admitted with AF was 50% (relative) higher than that observed for white patients. NOTE: It is estimated that there were 425,744 hospital admissions in the US for AF during 2008.

Deshmukh, A, et al. Comparison of outcomes of weekend versus weekday admissions for atrial fibrillation. American Journal of Cardiology, April 3, 2012 [Epub ahead of print]

[1] Kostis, WJ, et al. Weekend vs weekday admission and mortality from myocardial infarction. *New England Journal of Medicine*, Vol. 356, 2007, pp. 1099-1109

BNP level and risk of post-ablation recurrence

AUSTIN, TEXAS. Brain natriuretic peptide (BNP), a cousin of atrial natriuretic peptide (ANP), is a hormone released from the walls of the ventricles when stretched such as during unusually strenuous activity. It is stored as a prohormone within secretory granules in the ventricles and is secreted as an N-terminal fragment, N-terminal pro-brain natriuretic peptide (nt-pro-BNP), and the smaller active hormone BNP. BNP has effects similar to those of ANP, that is, it decreases sodium reabsorption rate, renin release, and aldosterone release; it also increases vagal (parasympathetic) tone and decreases adrenergic (sympathetic) tone. Because nt-pro-BNP is easier to measure than BNP it is often used as a marker for BNP.

It is well established that BNP and nt-pro-BNP levels are elevated in heart failure and that the degree of elevation is directly proportional to the seriousness of the failure. Researchers at the Massachusetts General Hospital have reported that lone afibbers also have elevated nt-pro-BNP values even when in sinus rhythm.

Now an international group of arrhythmia researchers led by Dr. Andrea Natale reports that pre-ablation BNP level predicts the risk of post-ablation recurrence in male afibbers. Their study

included 568 consecutive lone AF patients (no structural heart disease) who underwent a radiofrequency catheter ablation between April 2008 and February 2010 at St. David's Medical Center. The average age of the patients was 62 years, 73% were male, and the average number of years they had suffered from AF was 6.6 years. Twenty-five per cent of the study participants had paroxysmal AF, 38% had the persistent variety, and 37% had permanent (long-standing persistent) AF.

All patients had their baseline BNP level measured. The average BNP level for men was 87 pg/mL and 126 pg/mL for women. After undergoing a standard pulmonary vein antrum isolation procedure (PVAI) with additional lesions as required, the study participants were followed up for 12 months and arrhythmia recurrences were recorded after a 2-month blanking period. At the end of the study, 73% of male patients and 64% of female patients were in normal sinus rhythm without the use of antiarrhythmic drugs. Statistically significant predictors of AF recurrence for men were hypertension (associated with a reduced risk of recurrence) persistent or long-standing persistent AF, a BNP level above 50 pg/mL, and an enlarged atrium. Among women, the predictors were AF type

and hypertension (associated with a reduced risk of recurrence).

The researchers conclude that a high baseline BNP level (greater than or equal to 50 pg/mL) is a strong independent risk factor for AF recurrence in men having undergone a PVAI. Eighty per cent of men with a baseline BNP level below 50 pg/mL were free of arrhythmia without the use of antiarrhythmics 12 months following a single PVAI. The corresponding success rates for men with a BNP level at or above 50 pg/mL and for women (irrespective of BNP level) were 67% and 64% respectively.

Mohanty, S, Natale, A, et al. Baseline B-type natriuretic peptide: a gender-specific predictor of procedure-outcome in atrial fibrillation patients undergoing catheter ablation. Journal of Cardiovascular Electrophysiology, Vol. 22, August 2011, pp. 858-65

Editor's comment: The role of BNP in atrial fibrillation was discussed in detail in an earlier research report (<http://www.afibbers.org/resources/BNP.pdf>). The conclusion of this report was that BNP is an

important hormone released from the walls of the ventricles and, to some extent, the atria when stretched. It is well established that a high BNP level is associated with heart failure, but it is now also clear that elevated BNP levels are closely associated with atrial fibrillation including lone AF. BNP levels are higher in afibbers than in non-afibbers and those in permanent afibbers are higher than those in paroxysmal afibbers. A high BNP level is associated with a lower probability that cardioversion will be successful and also predicts a poor outcome of catheter ablation – at least for male afibbers. There is also evidence that an elevated BNP level in paroxysmal afibbers is associated with a quicker progression to the permanent state. Finally, some very recent research provides convincing evidence that an elevated BNP level is strongly associated with the risk of developing AF over a 10-year period following the baseline BNP determination. It is to be hoped that electrophysiologists will soon include a measurement of BNP or nt-pro-BNP in their initial evaluation of all afibbers and their relatives.

Long-term success and early recurrence after ablation

MONTREAL, CANADA. It is estimated that about 38% of afibbers undergoing radiofrequency catheter ablation for atrial fibrillation (AF) experience recurrence of arrhythmias (AF, atrial flutter or left atrial tachycardia) within the first 3 months following the procedure (early recurrence). Experiencing early recurrences of atrial tachyarrhythmias (ERAT) does not necessarily indicate long-term failure, since about 50% of those having ERAT go on to experience long-term freedom from atrial arrhythmias. Thus it is common practice to exclude arrhythmia episodes occurring during a 3-month blanking period when evaluating the long-term success of ablation procedures.

Laurent Macle, MD and colleagues at the Montreal Heart Institute and Southlake Regional Health Center in Newmarket, Ontario recently published a review of 20 studies addressing the question why do some afibbers with ERAT go on to experience long-term success, while other do not? Following are the highlights of this review.

- The rate of late recurrence (arrhythmia recurrence between 3 and 12 months post-ablation) is significantly higher among

ablates with ERAT (54%) than among those without ERAT (7%).

- ERAT may represent a transient and potentially reversible phenomenon due to proarrhythmic effects of the ablation (inflammation and autonomic nervous system modification).
- Longer term recurrence most likely reflects recovery of electrical conduction between pulmonary veins and the left atrium.
- Delayed success, as defined by late freedom from recurrent arrhythmias despite early recurrence, is associated with reverse electrical and structural remodelling related to the restoration of sinus rhythm and includes gradual shrinkage of the left atrium.
- Although it is generally assumed that lesions created by the ablation are fully healed as early as 2 weeks post-ablation, recent magnetic resonance imaging has shown that additional left atrial scar forms over the first 3 months post-ablation.

- Important predictors of ERAT are:
 - Advanced age
 - Hypertension
 - Structural heart disease
 - Genetic abnormalities (presence of 4q25 variant alleles)
 - Persistent or permanent AF
 - Duration of AF (time since diagnosis)
 - Increased P-wave dispersion
 - Left atrial enlargement
 - Decreased left ventricular ejection fraction
 - Post-procedure inflammation (elevated CRP level and body temperature)
 - Incomplete pulmonary vein isolation
 - AF not terminated at end of procedure or cardioversion required to do so
 - Multiple AF foci outside pulmonary veins
 - Absence of superior vena cava isolation.
- Predictors of late recurrence (3 to 12 months post-ablation) are:
 - Same factors as for ERAT except for increased P-wave dispersion and post-ablation inflammation
 - Male gender
 - Higher number of previously ineffective antiarrhythmics
 - Longer radiofrequency ablation time
 - Incomplete vagal denervation
 - Smaller percentage of left atrium isolated
 - Early recurrence (ERAT).

Of particular interest is the finding that late recurrence is highly dependent on the timing of ERAT. Nearly all (98%) of 1298 patients undergoing ablation, who experienced ERAT during the 3rd month of the blanking period, went on to experience late recurrence.

Another study demonstrated a significantly lower 6-month recurrence rate (24%) among patients who experienced immediate recurrence (within 3 days post-ablation) versus patients with recurrence between 3 days and 1 month. For this group, the 6-

month recurrence rate was 70%. It has also been observed that early symptomatic arrhythmia recurrences lasting 6 hours or longer are associated with a 100% risk of late recurrence. Other observations of interest are:

- Administration of antiarrhythmics for 6 weeks post-ablation reduces the risk of severe arrhythmias, hospitalizations, and cardioversions during the treatment period, but has no effect on long-term outcome.
- Administration of anti-inflammatory corticosteroids for 3 days following the ablation procedure reduces the incidence of early AF recurrence during the first month, especially during the first 72 hours. The long-term (14 months) freedom from AF (without antiarrhythmics) was higher in the corticosteroid group (85%) than in the group not receiving corticosteroids (71%).
- Cardioversion for recurrent arrhythmia should preferably be done within 30 days of the recurrence.
- If re-ablation is needed, it should preferably be carried out 3 months after the initial (failed) procedure.

Andrade, JG, Macle, L, et al. Early recurrence of atrial tachyarrhythmias following radiofrequency catheter ablation of atrial fibrillation. PACE, Vol. 35, January 2012, pp. 106-16

Editor's comment: This review is clearly of huge importance to both the EP and the patient in determining the likely long-term outcome of a radiofrequency catheter ablation for AF. The observation that early recurrence is associated with post-ablation inflammation supports the recommendations in my post-ablation care protocol www.afibbers.org/resources/postablationcare.pdf, to avoid strenuous exercise, and supplement with natural anti-inflammatories during the recovery period.

Comparison of Cox-Maze III and catheter ablation

ROCHESTER, MINNESOTA. The Cox-Maze III procedure is often described as the “gold standard” for curing atrial fibrillation (AF). The procedure uses a cut-and-sew protocol for creating lesions forming a “maze” that conducts electrical impulses from the sinoatrial (SA) node to the atrioventricular (AV) node while, at the same time, interrupting any “rogue” circuits. Creating the full set of maze lesions involves open-heart surgery and the

use of a heart/lung machine (cardiopulmonary bypass). For this reason, the Cox-Maze has been primarily used in afibbers who needed valve surgery or other procedures requiring access to the outside of the heart.

Although the cut-and-sew approach is still used by some surgeons, it has largely been replaced by the use of radiofrequency-powered devices to create the maze pattern. The main advantage of the original cut-and-sew is that it ensures “transmurality”; that is, the creation of lesions through the entire thickness of the heart tissue.

A group of cardiothoracic surgeons (NOTE: No electrophysiologists were involved in this study) from the Mayo Clinic now report on a study comparing the efficacy and safety of the Cox-Maze III cut-and-sew procedure (CSM) with that of radiofrequency catheter ablation (CA). The study involved 97 lone afibbers (no structural heart disease) who underwent CSM during the period 1993 to 2007. Average (median) age at time of surgery was 56 years, 68% of patients were male, and 69% had paroxysmal AF. The outcome for this (CSM) group was compared to that of a group of 194 lone afibbers who underwent CA during the period 1997 to 2007. Median age at time of ablation was 54 years, 71% of patients were male, and 71% had paroxysmal AF. The standard CSM procedure was used throughout the period 1993 to 2007, while 4 different versions of the CA procedure were used.

| CA Procedure | # of Patients | Period |
|---------------------------|---------------|-----------|
| Right-sided ablation only | 17 | 1997-2004 |
| Focal AF ablation | 37 | 1999-2003 |
| Segmental PVI | 91 | 1999-2006 |
| Circumferential PVI | 47 | 2003-2007 |

NOTE: The use of right-sided ablation only and focal ablation is now considered obsolete. At time of last follow-up (average of 5.6 years for CSM group and 3.1 years for CA group), the outcomes were as follows:

| Outcome | CSM Group | CA Group |
|---------------------|-----------|----------|
| Complete success(1) | 82% | 56% |
| Partial success(2) | 2% | 18% |
| Failure | 16% | 26% |
| Still on warfarin | 12% | 55% |

(1)Freedom from AF without use of antiarrhythmics

(2)Freedom from AF with use of antiarrhythmics

It should be noted that 24% of the patients in the CA group required a second ablation during the follow-up period, while 4.6% required a third procedure. In the CSM group, 6.5% underwent a catheter ablation to fix a failed maze procedure.

The procedure-related complications observed in this study are substantially more frequent and more serious than I ever recall seeing before.

| Complications | CSM Group | CA Group |
|----------------------------|--------------|------------|
| Death | 0% | 0% |
| Respiratory failure | 1.0% | 0% |
| Renal failure | 1.0% | 0% |
| Wound infection | 1.0% | 0% |
| Stroke/TIA | 2.1% | 1.0% |
| Pacemaker installation | 7.2% | 4.7% |
| AV node ablation | 2.1% | 2.6% |
| Pulmonary vein stenosis* | 0% | 10% |
| Pericardial effusion | 0% | 4.7% |
| Vascular access problems | 0% | 3.1% |
| Total complications | 15.5% | 26% |

**More than 50% reduction in vein diameter. NOTE: In their attempt to deal with the procedure-related pulmonary vein stenosis, the surgeons performed 18 balloon angioplasties and 11 stenting procedures in 14 patients.*

The authors of the study conclude that, "Compared with catheter-based ablation the Cox-Maze procedure results in greater freedom from AF and less medical treatment with antiarrhythmic drugs and warfarin anticoagulation during follow-up."

Stulak, JM, et al. Ablation of atrial fibrillation: comparison of catheter-based techniques and the Cox-Maze III operation. Annals of Thoracic Surgery, Vol. 91, June 2011, pp. 1882-89

Editor's comment: This study would appear to be an attempt to justify the use of the highly invasive Cox-Maze III procedure to treat patients with lone AF. The efficacy and safety of the procedure compared with that of radiofrequency catheter ablation is highly favourable of the maze and very much biased against catheter ablation. Thus, it is not surprising that members of the Mayo Clinic's electrophysiology department refused to participate in the study and to act as co-authors of the article.

The complete success rate (no AF, no antiarrhythmics) of 56% achieved after an average of 1.3 CA procedures per patient is clearly very low when compared to the 70 to 90% final complete success rates now achieved in world class ablation centres. The total complication rate for the CA group at 26% (major complication rate of 24%) is clearly totally out-of-line with that reported in other studies. A study involving 517 patients who underwent RF ablation at Johns Hopkins in Baltimore reported a total complication rate of 5%, of which, pulmonary vein stenosis accounted for 0.2%, and pacemaker installation and AV node ablation accounted for 0%. A study involving 400 patients who underwent RF ablation at the Cleveland Clinic reported a major complication rate of 1.6%, of which, pulmonary veins stenosis accounted for 0.25%, and pacemaker installation and AV node ablation accounted for 0%. A study involving 1642 RF ablation procedures carried out at the University of Michigan reported a total complication rate of 3.5% with pulmonary veins stenosis accounting for 0.1%, and pacemaker installation and AV node ablation accounting for 0%.

Clearly the success rate is unacceptably low and the complication rate unacceptably high in this study of the efficacy and safety of radiofrequency catheter ablation as performed at the Mayo Clinic. The complication rate for the Cox-Maze is also unacceptably high making it a very poor choice for lone afibbers. It is not clear who actually performed the catheter ablations discussed in the report, but it is safe to say that whoever did them were not competent to do so. The Mayo Clinic (Rochester) does have very competent electrophysiologists on staff, notably Dr. Douglas Packer.

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