SAMIR SABA: So I'm going to be spending about 30 to 35 minutes talking about atrial fibrillation and concentrating on the role of ablation in today's world of managing atrial fibrillation. The topic or the title that I was given was, "Atrial Fibrillation-- To Treat or to Ablate." So I just want to quickly reassure you that ablation is actually a form of treatment. It's not leaving the patient alone. These are my disclosures.

So we're going to be talking a lot about a lot of things in atrial fibrillation today. We're going to talk about the heterogeneous population that can be affected by atrial fibrillation. I searched this picture to show as heterogeneous a group as possible. Needless to say, if we were to guess who are the patients that are most likely in this picture to have a atrial fibrillation, we're going to focus on these two ladies because you know atrial fibrillation, as you well know, and as I'm going to be showing is a disease of getting older. It becomes much more frequent in that age group. However, it can happen to any of the patients and we have to keep that in mind as we're managing our patients.

The second thing we're going to talk about is really from a management perspective. What are the things that we need to concentrate on when we're seeing a patient with atrial fibrillation? The first thing, the most important thing in my mind when I'm seeing a patient with atrial fibrillation is to assess the risk of thromboembolism. Stroke, basically. As well as clots going somewhere else in the body. Because of all the things the bad things that can happen to patients, that is the one that could be definitely associated with very poor outcomes and you rarely redeem yourself after your patient has had a stroke.

The second thing is obviously symptoms. And many times the patients show up in our clinics because they are not feeling too good and they have symptoms. And thirdly, in patients that have very fast atrial fibrillation, you want to make sure that there is no risk of them developing what we call tachycardia induced cardiomyopathy which is a cardiomyopathy as I'm going to elaborate a little bit more related to the fast rhythm and the fast rate. And then we're going to talk about the strategies. The two general strategies of managing atrial fibrillation. Rate control. Accepting atrial fibrillation but just making sure it's not going fast. Or rhythm control and ablation falls under that category as one of the forms of rhythm control for atrial fibrillation.

We're going to focus a little bit about atrial fibrillation ablation. You know I'm acutely aware of the fact that in a general medicine audience, most of you know that there is atrial fibrillation maybe not very acquainted with what does it entail to do an atrial fibrillation ablation. Then finally, tell you how we're going to approach those patients.

All right it's a very wide spectrum of patients and I chose two profiles of patients to illustrate on the one hand, one end of the spectrum on the other hand, the other end. So Mr. DM, 87-year-old gentleman, structural abnormalities of the heart coronary artery disease, stents, prior stroke in 2007, years ago. And he presents because he basically had a syncope spell as he was going to the bathroom. And he was found to have atrial fibrillation and the rate was not fast, 70 beats per minute. No symptoms. And as we can all tell in this patient, it's an incidental finding. The patient did not show up because of atrial fibrillation. The syncope spell very unlikely that it was related to atrial fibrillation.

Compare and contrast this patient to Mr. JL who is 45 years old. Who has a negative cardiac history. Younger person. Woke up from sleep. The palpitations woke him up from sleep, shortness of breath and he had-- there may be a trigger there. He had binge drinking the night before and he was found to be in atrial fibrillation going at a rate of 145 beats per minute and it spontaneously converted on its own. So on the one hand, we have the patient who has zero symptoms, older, lots of comorbidities. On the other hand, you have the younger person shouldn't have atrial fibrillation by any of our predictive criteria and who has paroxysmal atrial fibrillation. It converts on its own. Very symptomatic, very fast heart rate.

So these are a couple of graphs to illustrate what you already know. Atrial fibrillation definitely the prevalence of atrial fibrillation increases significantly as the patient gets older. It's several fold higher when the patient is in their 60s, 70s, and 80s compared to when they in their 30s, 40s, and 50s. And not only is it the age by years that adds to the prevalence of atrial fibrillation, but it is also when the heart is aging. So when you look at patients, the prevalence of atrial fibrillation in patients who have heart failure or who have weakened muscle of the heart will have basically problems with their heart. As you move from the class one or all the way to class four, you go from single digit incidence or prevalence, I should say, of atrial fibrillation all way to about 50% prevalence of atrial fibrillation in this population. Which tells you that it's not only the number of years of age, but also it's how bad the cardiac situation is.

And there are a lot of other risk factors but those are probably the strongest associations in terms of who gets atrial fibrillation. We're going to come back to this whole heart failure population that has atrial fibrillation because for years, we stayed away. At least when we're talking about Afib ablation, this is a high risk population. The procedure is long and tedious, at least it used to be. So we didn't touch those patients and now we know, and I'm going to show you some of these data, that maybe this is the population that gets the most benefit from an Afib ablation.

Again, going back to the demographics, as we go from this you know younger person who doesn't have any comorbidities, who has paroxysmal atrial fibrillation, no heart disease, all the way to the elder person with lots of comorbidities, with congestive heart failure, probably, prior strokes and the CHADS2-VASc score, which is the measure of the risk of thromboembolic events goes higher, other things happen. So needless to say, the patient becomes a higher risk in terms of worse outcomes, mortality, and stroke as we move along this path.

But also the pattern of atrial fibrillation gets to change. We go from paroxysmal atrial fibrillation to what we call persistent atrial fibrillation meaning that the patient is now in atrial fibrillation and you have to do something like shock them, cardiovert them to get them out of the abnormal rhythm. All the way to chronic or permanent atrial fibrillation where, no matter what you do, they go back into atrial fibrillation in which case you have to just concede the fact that they're going to be in atrial fibrillation. And that natural transition-- you start with paroxysms and those paroxysms will become more frequent and longer and at some point they coalesce into a persistent atrial fibrillation and then permanent.

That transition goes hand in hand with the fact that treatment or the success of treating atrial fibrillation and maintaining sinus rhythm becomes worse. So our likelihood of being able to maintain sinus rhythm is going to go down as we progress from paroxysmal to persistent to permanent. All right. Atrial fibrillation. Historically, the mechanism of atrial fibrillation was felt to be a very chaotic, abnormal electricity in the upper chambers of the heart without any rhyme or reason of where it starts or how it sustains itself. And this is why the treatment was mainly not an ablation treatment. I mean, we all know what an ablation is. Historically, we've done it for SVTs where you have a specific location in the heart where you have to place a catheter, heat the tip of the catheter, and to about 60 degrees Celsius clearly higher than our body temperature. That cauterizes the tiny little fibers inside the heart responsible for the abnormal rhythm.

How would you do that in the atria, a lot of real estate there, if it's a chaotic rhythm coming from everywhere? So really the treatment was oral anticoagulation to prevent strokes and rate control medications, rhythm control medications, and we'll go over these, simply. And maybe in about 5% of patients, we used to do ablations because the patient has atrial fibrillation but we uncover that there is an SVT mechanism. There could be an accessory pathway. The patient goes into an SVT and that SVT degenerates into atrial fibrillation. So we say you know what, we're going to go and ablate the SVT which we've always been very good at doing that with very high success rates in the 90 plus percent rate. And that may translate into, as we eliminate the SVT mechanism into eliminating the atrial fibrillation mechanism.

All right. We're going to talk about the main things that we concentrate on when we see a patient with atrial fibrillation and those are things most of us know. One, we need to make sure that the patient is as protected as they can be against thromboembolic events. And really stroke is the one thing that we fear the most because that's the most damaging and it affects the quality of life and the longevity of patients thereafter. And in the context of atrial fibrillation, part of the problem is the fact that the atria are quivering in place, they're not moving. So there is an element of stasis that is contributing to the formation of clots. And the clots typically form mainly in the left atrial appendage, why? Because it's a blind pouch, correct? There is less movement of the blood, particularly in the context of a heart that is not contracting-- that is just quivering in place. That's part of the equation.

The other part of the equation is the fact that the patient in atrial fibrillation may have a lot of risk factors. There are a lot of theories. Inflammation or what have you. But there is a hypercoagulable state, which is why even when we eliminate atrial fibrillation, completely eliminate atrial fibrillation, we do not tell our patients, oh you don't need to be on blood thinners anymore. Even with zero atrial fibrillation. The driver today by today's criteria, the driver of whether the patient should be on a blood thinner or not is the CHADS2-VASc score which I'm going to talk a little bit about on the next slide, not whether the patient has atrial fibrillation or not because the atrial fibrillation brings a hypercoagulable state.

And the association between stroke and atrial fibrillation is a very intimate one. With atrial fibrillation, the incidence of stroke is three to five-fold increased in those patients. The converse is true. About 15% of all the strokes that we have are attributable to atrial fibrillation irrespective of whether at the time of the stroke, the patient was known to have atrial fibrillation or not. We all hear about those cryptogenic strokes. Patients that have strokes, we don't have a good explanation. Now we have tiny little monitors that we implant in those patients. And we can monitor the patient continuously for two and a half years. A significant proportion of those patients end up showing atrial fibrillation that is asymptomatic. Otherwise, they would have shown up before the stroke and that is a major mechanism for the atrial fibrillation causing this-- that's the mechanism of the stroke, which is atrial fibrillation.

All right. This is the CHADS2-VASc score. It's a score that takes a bunch of clinical criteria. It's a score that goes from 0 to 9. And if you have congestive heart failure, you get a points. You have hypertension you get a point. Age above 65, you get one point. Above 75 you get two points. Prior TIA or stroke, you get two points. Diabetes and gender. Female gender gets you a point only if you have another point. Meaning that if you are at a CHADS2-VASc of zero, even as a woman, you would be at a CHADS2-VASc of zero but if you have hypertension which gives you one point, female gender gets you a second point so you are immediately at two points.

And what we know about the CHADS2-VASc score is the fact that you don't have to have a high score to have a higher risk of stroke. Look at the annual risk of stroke. 2% with a CHADS2-VASc of two and at that level you need to be on oral anticoagulation. With the 0 and one, you could be on antiplatelet agents. With any higher than two, you need to be on oral anticoagulation and historically that was Warfarin. Now we have the newer DOACs. There are five of them on the market at this point. And that drives the treatment of, or the protection of the patients who have atrial fibrillation against a thromboembolic event.

And as you can tell, the risk of patients as the CHADS2-VASc score goes higher, those are the same patients that have a high risk of bleeding. I'm going to let this video play. This is basically showing you what a left atrial appendage closure procedure looks like. You have a catheter across the septum transeptally from a groin line and you basically go in and deploy one of the approved product today. It's called Watchman and it plugs the left atrial appendage with the hope that basically stops any clots that, in more than 95% of patients, form and the left atrial appendage prevents it from going out. And all what you need to do after you've done this procedure is to wait 45 days while the patient is still on anticoagulation in order to allow enough time for the device to endothelialize and beyond that you just have the patients on antiplatelet agents.

Why is that important? It's because of what I just said, which is that the patients that have the highest risk of stroke are the same patients that have the highest risk of bleeding. And you are stuck between a rock and a hard place. Which is better it bleeds or a stroke? I don't know. And this gives us an opportunity to be able to treat those patients in a different way. Now needless to say, I told you that the atrial fibrillation is a hypercoagulable state. Most of the clots form in the left atrial appendage but not every single one forms there so you're always concerned by plugging the left atrial appendage, am I fully protecting the patient? The answer is maybe not. This is why class 1 indication is still today that you will treat the patient with anticoagulation if you can.

If the patient is going to be not on anticoagulation because of a high risk of bleeding, then be aware of the fact that they do have an option. And more of those devices are going through the regulatory process and we're going to have many options down the line of looking at plugging the left atrial appendage without having to do a surgery. Choose to be open heart surgery for a surgeon to clip it or take it out or sew it down and now it doesn't have to happen.

And the data that led to this device getting approved is from a couple of trials PREVAIL and PROTECT. These are the data from PROTECT over the course of about four years. The endpoint of death, stroke, or any thromboembolic event was equivalent between being on a blood thinner or having the left atrial appendage closure device. Needless to say the risk of bleeding was higher and the blood thinner population as opposed to the left atrial appendage closure.

All right. Second concern beyond the thromboembolic risk is symptoms. And we've seen patients can be completely asymptomatic or can be very symptomatic. I find it most difficult to know whether to attribute the symptoms to atrial fibrillation or not. A lot of patients come in and they're short of breath, and they're feeling fatigued, and tired. And they're in atrial fibrillation. The ventricle response rate is 90 beats per minute. Is it because of atrial fibrillation or are these two things true and unrelated? This is where it becomes a little bit difficult. And many times this is where the value of putting the patient back in normal rhythm or slowing down the rate if they are going fast, becomes very valuable. Even if it does not stick for the long term. Even if you had one week of normal sinus rhythm in that patient, it will answer the question are there symptoms because of the atrial fibrillation? Because if they are not because of the atrial fibrillation, you don't have to do too much. You just have to protect them and not dwell too much on putting them through cardio versions and medications and ablations.

And then last but not least, in terms of the concerns as you're facing your patients with atrial fibrillation is this whole concept of tachycardia induced cardiomyopathy. The mechanism of it has been worked up. It's mainly our best understanding of it at this point is mainly depletion of the energetics of the muscles of the heart because the heart is beating very fast for an incessant way. So think about the analogy of if you had a horse that you're working day in and day out and you're not feeding it. It's going to weaken at some point. The good news is that when you see tachycardia induced cardiomyopathy, it's reversible.

So if you control the rate or you put the patient back in normal rhythm, that patient will recover their ejection fraction that could be as low as 10% or 15% will recover the rejection fraction, which will go back to a normal ejection fraction. At the time when you see the patient, however, you do not know which came first, the chicken or the egg. Is the patient having a low ejection fraction because of a fast atrial fibrillation or is it that they have heart failure and some other reason for the low ejection fraction that has led to atrial fibrillation. And as I showed you before, in the context of heart failure, you have a lot of prevalence of atrial fibrillation.

The only way to discern which it is the chicken or the egg is to basically control the rate or cardiovert the patient, maintain sinus rhythm for a while and over the course of weeks. If it is the Afib leading to the tachycardia induced myopathy, then it should recover. If it does not recover, then by default you say it was the other way around.

All right. Two strategies for managing atrial fibrillation. One is rate control strategy. What is the strategy here? The concept is simple. The atrial fibrillation is coming from the top chambers of the heart. The pulse rate or the heart rate is driven by how fast the ventricles are following. All the conduction in the overwhelming majority of patients is only through the AV node and the His-Purkinje system. So can we give the patient enough medications to control the rate and that's basically Digoxin. Which does not work that well although it's very often prescribed. That's also beta blockers or calcium channel blockers. If you get to the point where the patient can no longer tolerate higher doses or you've reached the maximum dose of all of these medications and you can no longer give them more because of a low blood pressure or side effects or what have you or it just doesn't work.

The heart rate of the ventricles continues to be at a very fast rate. Then you have the option of an invasive procedure where you do what we call an AV node ablation. You basically ablate the AV node. You create hard block that obviously would necessitate putting in a pacemaker in this patient in order to keep the ventricles going at a good rate. And that's a fairly common procedure that we do with excellent results. Patients get symptomatic relief. They don't have to be on their medications anymore after you've marinated them with Lopressor and calcium channel blockers at high doses which start becoming part of the problem as they feel tired and fatigued. You can take of all of these things. The only thing after an AV node pacer-- AV node ablation and pacer that you need to treat them with is a blood thinner and the rest of the medications are no longer needed for atrial fibrillation.

The other management strategy is basically rhythm management. This is where we're not ready to concede that we're going to accept atrial fibrillation. We want to maintain the patient in normal rhythm. And if you remember your Vaughan Williams classification of the antiarrhythmic medications. They typically fall into either the sodium channel blockers. At this point, we only talk about the class 1C agents, Propafenone and Flecainide which are only used in the context of a normal heart. You cannot use it if somebody had an MI. You cannot use these medications if somebody has a cardiomyopathy. They have been associated in the context of his structurally abnormal heart with poor outcomes with high mortality. So in a normal heart, in a patient that has atrial fibrillation but otherwise no structural abnormalities, the 1C agents are definitely useful.

Then you have the class three agents. Those are the potassium blockers, Sotolol and Dofetilide And as you well know, as we are initiating these medications because these are QT prolonging medications, we would bring the patients into the hospital. We watch what their QT is doing. We titrate the dose up or down depending on how well the patient is responding. And then once we're settling on the dose that is effective and not too high from QT prolongation perspective, we send the patient home.

Amiodarone is technically a sodium blocker but it blocks so many things. And it has such a different profile in terms of toxicities that I like to mention it as a separate thing. As a separate category but technically it falls under the class three agents and here as you know, we like to reserve this medication as a last resort. It's probably the more effective or the most effective of all the medications to maintain sinus rhythm. But we don't like to use it frequently because of its toxicities namely lungs, liver, thyroid. And whenever you have your patients on these medications, every six months PFTs, LFTs, TFTs to make sure that we're not falling behind the eight ball on any of these things.

And then obviously cardioversion plus or minus a drug is one way of restoring normal sinus rhythm. And then atrial fibrillation ablation, which is really the novel thing. Novel meaning since 2000. We haven't had it forever as one of the options is the way to treat the Afib without the need for medications and try to maintain normal sinus rhythm. So how do we choose the strategy? First of all, you need to know that there is no right or wrong. Which one is better? Rhythm control or rate control has been studied a lot and there is no right or wrong. You just have to decide which of the patients should go down the route of the rhythm control and who should not. And usually, if you're very much on the fence, It's accepted that everybody deserves at least one attempt at restoring normal sinus rhythm and if you know they're not a good candidate for too many attempts and too many medications on hospitalizations and what have you, then you'll leave them be.

So the advantages and disadvantages of rate vs. rhythm control, the things that would make you actually favor rate control would be if the patient is asymptomatic. You cannot attribute any of the symptoms to the atrial fibrillation. If they're older, they have persistent atrial fibrillation. Any of the features that would make you feel the likelihood of restoring normal sinus rhythm and maintaining it is low, you go ahead with rate control.

Rhythm control, younger person, paroxysmal pattern, not a big atrium so it's not a dilated atrium, you go ahead and try to use medications or ablation to maintain sinus rhythm. And the whole choice comparing rhythm versus rate control has been studied in a number of studies. The AFFIRM trial is the one we talked the most about because by far it was the largest. And the results of the AFFIRM trial looking at the all cause mortality result showed that rhythm versus rate control did not make a difference in terms of the all cause mortality outcome, which was the primary outcome of this study. So that's part of the reason why we say there is really no right or wrong answer. You just have to do what's right for the patient.

You can see there is a trend towards higher event rates and the rhythm control medications arm. And that's because it was felt that it's because of some pro arrhythmic effect of the medications which is why the ablation is very looked favorably upon because now you have a rhythm control strategy that does not involve putting the patient on medication. So now, going back to our original two scenarios Mr. DM and Mr JL. Clearly, you would be leaning towards rate control in the first patient, rhythm control in the second patient, although it's not a black and white decision.

All right. Shifting gears to talk a little bit about Afib ablations. As I said, historically, we've thought it's completely chaotic and we don't know where the arrhythmia starts and where it comes from and how it sustains itself. It turns out that that's not true. The group in Bordeaux, the Hasegawa group, published in 99 or 98, actually, a study showing that the overwhelming majority of atrial fibrillation starts in the pulmonary veins. Those are the veins that bring the blood back from the lungs into the left atrium and then they put the atrial fibrillation patient in atrial fibrillation for that episode and every time it starts, it starts there.

And that has transformed the field of ablation and created the field of ablation. The electrophysiology field approached it like any ablation that we have done historically. We take a catheter and we try to find the spot within the one pulmonary vein that basically initiated the abnormal rhythm. This is a reconstructed CT scan showing you the atrium, the left atrium from the inside. So you have the left superior. This is the orifice of the left superior. left inferior, right superior, right inferior. And this is the left atrial appendage here and you have the ridge between them.

So we basically approach it as I'm going to go into the one pulmonary vein and ablate it. And then we discovered that you ablate one focus in the pulmonary vein and another focus in that same pulmonary vein or another pulmonary vein starts popping up and causing trouble. We started doing the two on the left and then leaving the two on the right, separately. And we ended up having to do all four pulmonary veins, which is today, what a pulmonary vein isolation or Afib ablation for paroxysmal atrial fibrillation looks like.

So we draw circles creating lines of block in that area and we have to adapt to the anatomy. It's a very anatomically driven procedure. We don't need to see atrial fibrillation during any Afib ablation. We're going to the anatomy and we're isolating electrically the pulmonary veins. That's all we're doing. We can go in and out and do that and then we figure out if it worked or didn't work. But you can see most patients 80% have four pulmonary veins. Some people have three. Some people have five. Some people have six. Which is why we get those CAT scans ahead of time to get a roadmap of where we're going to go and where we're going to be ablating in order to get a good result.

And again, using the tools of what we had, the catheters, we used to go point by point and draw lines or circles, if you want, around the pulmonary veins. And this is a very tedious procedure because not only is the heart beating, but the chest is-- the patient is breathing and you're trying to connect the dots. Take a piece of paper and take a pencil and try to make a circle connecting dots and you'll see how difficult and tedious it is but the technology catches up fairly quickly. About seven, eight years ago we started having the cryoballoon ablation, which is basically you plug the vein where the balloon is touching the rim of the vein and then you freeze the balloon. It's cryo energy. You can basically isolate the vein completely.

And I'm going to go quickly over some of the data from what is the value of Afib ablation in paroxysmal patients. And the reason why I'm making the distinction between paroxysmal and persistent is because it's accepted that the only thing that you need to do for an Afib ablation in the world of paroxysmal atrial fibrillation where the patient goes in and out on their own, is isolate the veins. In persistent atrial fibrillation, the results are not as good. So the field has been for a long period of time struggling with besides the pulmonary vein isolation, what else do we need to do in order to improve the success rate of our ablations.

But for the paroxysmal atrial fibrillation, lots of trials. One of them is the STOP-AF trial which randomized patients to the cryoballoon pulmonary vein isolation versus medical therapy. And you can tell there is a huge difference over time in terms of who maintain sinus rhythm with the medications which is very poor versus with the ablation. On the lower graph, when you look at the patients that crossed over from medications to ablation, they have a similar result. So clearly, as long as you have an ablation, it doesn't matter which arm of the procedure you are and you are you're going to have a better success rate in terms of maintaining sinus rhythm. There are a lot of the same trials. In paroxysmal atrial fibrillation, if you isolate the pulmonary veins, the success rate at one year is about 80%

That's repeatedly documented in multiple studies including our own data. And this table here is from our own data showing that the complication rates of the procedures are really very, very small. The main complication rate of the procedure at this point is phrenic nerve, transient phrenic nerve injury. As you're freezing the tissue you may affect the phrenic nerve. This is why we monitor it continuously. We are stimulating-- we're giving the patient hiccups continuously during the procedure to make sure that the diaphragm is continuing to contract.

As you can tell, there was a lot of questioning a few years ago about is ablating with the radial frequency catheter where you go point by point better or more durable versus the cryoballoon and like any new therapy, you know people question whether it's as good as what we were used to. And the trial that answered this question as published in the New England Journal in 2016 was FIRE AND ICE. And FIRE AND ICE compared these two strategies and showed that from an efficacy perspective, efficacy being defined as a recurrence of AFib, Aflutter, redo ablation, or use of an antiarrhythmic drugs.

The two approaches were the same from a safety perspective. Death, stroke or any other adverse events they were equally good. The main difference, however, is with the application of the balloon where you're kind of like as if you had a stamp on your stamping a circle on a piece of paper as opposed to the point by point. The duration of the procedure was cut down significantly. It used to take me-- I would go into a case at 8:30 in the morning. Probably emerged from that case at 1:00 or 2:00 in the afternoon. Now you can emerge from that case after having done exactly the same around 9:30, 10:00 in the morning so that's the transformation.

With persistent atrial fibrillation, the field has struggled, as I told you, with where else should we ablate outside of the veins in order to maintain sinus rhythm? And there have been a lot of speculations as to what would bring added value. Do we ablate in the right atrium? Do what we call a flutter isthmus flutter ablation? Do we do some rooflines or isthmus lines in the left atrium? Do we go and map rotors or ganglionic plexi which are the nerve endings that innervate the heart on the epicardium. Do I ablate those in order to improve the outcomes of ablations of persistent atrial fibrillation and the answer is none of these things panned out in a randomized trial.

I'm going to show you just two. The [INAUDIBLE] study. Doing PVI plus ganglionic plexi versus PVI in paroxysmal atrial fibrillation, PVI plus lines plus ganglionic plexi compared to PVI plus lines. No difference in the outcome. So doing the ganglionic plexi does not make a difference. The STAR AF trial is the one that we quote the most. Again, doing the pulmonary veins only. Pulmonary veins with the ablation of signal in the atrium, the CFAEs, what we call continuous atrial fragmented electrograms versus doing lines. Again, no difference in the outcome.

So as of today, there is really no added value from other lesions except that now the field is at the point where we're testing what we call the posterior wall isolation. So we ablate the veins on the right on the left. And if we create a box lesion and isolate the posterior wall, one randomized small trial showed a potential benefit there. And this is another trial that showed the same but all small trials. So this is a patient that we've done here when we see that after isolating the veins, we still have a lot of disease in the posterior wall red is scar, basically, within a blade and we scar it out completely to see if that improves the outcome.

The field is moving towards creating more tools for ablating in single applications, meaning that everybody's moving away from the point by point catheter ablation but nobody wants to concede that cryo into energy is better than RF energy. So this is a new clinical trial coming soon that we're going to be part of it and it's looking at a RF balloon which has a camera inside of it. So we'll be able to see how well positioned the electrodes are around the veins before we ablate. in Japan, they're using a hot balloon which is basically heating. Thermal heat that would ablate the tissue. But again, it's single application with a balloon. There is another FDA approved product which is a laser balloon. Again, all tools but the field is definitely moving towards single application.

A couple of trials now that I want to briefly talk about. You probably heard about the CABANA trial. This is a trial that started in 2009. It took till 2017 to looking at is the ablation better than medical therapy for the outcome of a composite outcome of death, stroke, bleeding or cardiac arrest. And medical therapy was anything you wanted, rhythm control with medications, rate control with medications, et cetera. And the result of that study came back negative. So if you took all comers there was no difference in that primary endpoint of death, or stroke, or bleeding, or cardiac arrest in the two arms. But there is a big flaw in that trial which is the fact that nobody does an Afib ablation today because we tell the patient I want you to live longer. Death as an end point for an Afib ablation is not why we do Afib ablation. Actually, it's opposite to what the guidelines say. The guidelines would tell you that you need to do Afib ablation in order to improve patient's symptoms not in order to prolong life.

There was something really flawed with this trial that was recently published but it has not changed the approach to the patients because again, nobody's offering an Afib ablation to prolong life. Having said that, CASTLE-AF, I told you earlier that we've shied away for years from touching patients with an ablation who have heart failure. CASTLE-AF was a much smaller study that again published recently in the New England Journal comparing any heart failure population patients with low ejection fraction class to 3 or 4 comparing a fib ablation versus medical therapy and in that population, in that very sick population which now we can do an ablation on because the ablation takes an hour as opposed to taking six hours. There was an improvement in the primary endpoint of death or heart failure or hospitalization and this in this population. So again the population that we thought we shouldn't even approach with any further ablation seem to be extracting the most benefits.

So in terms of what the guidelines tell us, briefly. Class one indication for an Afib ablation is to improve patient's symptoms. We should never tell a patient that an Afib ablation is going to prolong their life for the general population. Now we are starting to have some data to suggest that maybe in the heart failure population that would be a reasonable thing to say. Definitely and that's are very common thing that I see. We should never do an Afib ablation if the patient cannot be on anticoagulation. You need the anticoagulation at the time of the procedure and following the procedure. And we should never do an Afib ablation because we want to tell a patient or because a patient tells us I don't want to be on anticoagulation. The anticoagulation is, as I said earlier, irrespective of whether we maintain sinus rhythm or whether we did not. It's driven by the CHADS2-VASc score regardless of whether we see Afib or not.

And this is the algorithm that is taken from the last guidelines for atrial fibrillation management in 2014. And as you can tell, whether you have structural heart disease or no structural heart disease you know the catheter ablation is or can be a first line therapy. You see these little markers. It just says that Afib ablation is an option as a first line therapy for your patients as long as the patient understands the pros and cons and wants it. So going back to the informed consent that we heard about in the previous talk but also there needs to be good expertise at the site meaning high volume of people that do it frequently.

Where is the field going as I alluded to? it's going towards better tools to make to really make that this procedure available to any person. Being able to do it in the community hospitals. There are a lot of adjunctive therapies that happen hand-in-hand with the Afib ablation that are being tested. Renal denervation is being tested in a clinical trial to see if it improves the outcomes of atrial fibrillation and hypertensive patients so a lot happening in that field. And I'm going to stop here and entertain any questions. Thank you.