

Best Practices for Avoiding Esophageal Injury: Interview with Vivek Reddy, MD

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EP Lab Digest

Issue Number:

[Volume 14 - Issue 5 - May 2014](#)

In this feature interview we speak with Dr. Vivek Reddy, Director of the Cardiac Arrhythmia Service at Mount Sinai Hospital, about his use of the CIRCA S-CATH™ for helping to avoid esophageal injury during atrial fibrillation ablation.

What is the occurrence of atrial-esophageal fistulas during atrial fibrillation ablation in clinical practice? Do you think this complication is accurately reported?

During atrial fibrillation (AF) ablation, probably the most feared complication is atrial-esophageal (AE) fistula. Fortunately, the frequency is low; approximately 1 in 10,000-20,000



Vivek Reddy, MD

patients experiences an AE fistula. Having said that, as we start using newer technologies with potentially greater power ablation, the rate of AE fistula may actually increase. For example, we used non-irrigated catheters for a long time and never saw an AE fistula. Around 2004, as we started using 8-mm-tip catheters and irrigated radiofrequency ablation catheters, and we started seeing fistulas in the setting of AF ablation. Other kinds of technologies (such as focused ultrasound) that have since fallen out of favor had AE fistula formation occurring at an alarmingly high rate of almost 1-2%. Newer and more powerful ablation technologies are still becoming available, and with each technology, it is important to understand the rate of occurrence.

What role does heating of the esophagus play in the creation of these fistulas? Are there established limits to esophageal temperatures? At what temperature does injury occur?

Injury occurs when you get past 50 degrees Celsius in any tissue. The question is, after ablation of how much of the esophagus does one see AE fistula formation? The answer is, we don't know. We believe that once a certain amount of tissue is ablated and that the mass of tissue is

high enough, some percentage of patients will have abnormal healing, which allows for fistula formation and all the problems associated with that.

How important is it to avoid heating of the esophagus?

It is the heating of the esophagus that potentiates AE fistula formation, so we believe that this it is critically important to minimize esophageal heating.

Does this complication also exist with cryoablation? Is it possible to avoid freezing the esophagus? At what “cold” temperature does injury occur to the esophagus?

Yes it can occur. For a long time we thought it couldn't occur with cryo, but we were wrong. It clearly can occur with cryo and has been described in literature. We don't have as good of an understanding as to the temperature that esophageal injury occurs.

How important is temperature monitoring in avoiding esophageal injury?

We believe it's very important. It's hard to do any studies with fistula formation as the endpoint, because (fortunately) it's not common enough that you need such an enormous study to ask any of these questions. Therefore, we use esophageal ulceration as a surrogate. If you perform an endoscopy after the ablation procedure, there is a certain percentage of patients where you will see esophageal ulceration formation. This percentage ranges in the literature from a couple of percent to as high as 50%. We believe this is an early form of injury — a worse form of injury would of course be fistula formation.

How do you monitor esophageal temperatures at Mount Sinai Hospital?

In the past we used the readily available esophageal temperature probe with a single thermistor.



Therefore, we just had a single point of monitoring. The problem with that was the anesthesiologist constantly had to move the temperature probe up and down in the esophagus, because when ablating, you have to make sure that the probe is close-by, otherwise it's not really reflecting what is happening in the esophagus. For the last two and a half years, we have been using the new CIRCA S-CATH esophageal temperature probe (CIRCA Scientific, LLC). This has a total of 12 temperature sensors, so you have a better spread of what is going on in terms of the hottest location in the esophagus than if you're just using a single sensor. We use the S-CATH now in every single AF case.

At Mount Sinai, who places the CIRCA S-CATH probe in your lab during the procedure? Is it easy to insert?

We do our cases with general anesthesia, so typically it's the anesthesiologist or the CRNA who places the probe. It's a very standard thing for an anesthesiologist to insert.

Did the anesthesia staff accept the change to the new probe?

They are always putting stuff in the esophagus for various reasons, and oftentimes have their



own esophageal temperature probe just to monitor core temperature. So this was actually very easy for them to do.

In the past, did the anesthesia staff need to reposition the conventional single-sensor probe in order to cover different portions of the esophagus? How did that affect their radiation exposure?

Yes, we would instruct them to move the probe up or down several centimeters, and they would move it. When doing this, you have to fluoro more in order to show the position, so yes I would imagine the radiation exposure would increase. We haven't specifically studied that, but the advantage now with having this catheter with multiple sensors is that once they position it, there is no movement.

Describe the S-CATH's unique shape and the advantages this provides.

The S-CATH's shape snakes back and forth. In the esophagus you want to monitor the temperature at the proper vertical location, but the esophagus also has a certain amount of width to it, so you want to make sure that you cover as much of the width of the esophagus as possible. So through its design, we believe the S-CATH is able to give us a better spread of what is going on.

What settings do you use for the CIRCA system's warning and alarms? How does this guide your ablation, and what is your cut-off temperature when using RF?

Once the temperature reaches 39 degrees, we stop ablating. We typically set the warning, which is a lower level beep, at 37.5 degrees; we set the alarm at 38.5 degrees. Therefore, when the alarm starts going off, we know that very soon we have to stop energy, because when it gets to 39 degrees, we will stop delivering energy.

What is your cut-off temperature when using cryo?

Once it drops to 20 degrees, we stop ablating. I do want to point out, though, that there is very little data on the proper temperature cut-off that one should employ with cryo, but this is the

approach we employ. We have more experience with esophageal temperature monitoring using radiofrequency.

What advantage does the CIRCA probe's 12 temperature sensors provide to you during a procedure? Does location of the sensor affect the accuracy of the temperature readings?

Temperature monitoring is a way to minimize damage to the esophagus. With this particular probe, you do not have to worry about where the position of the probe is relative to the ablation catheter — you can just proceed with the ablation. If the temperature is rising, you know that you have to stop ablating so that you don't have to have the anesthesiologist constantly moving the probe up and down.

Does the location of the single sensor affect the speed of the temperature reading?

How critical is this temperature lag?

It does. That is true with any temperature sensor; if you are ablating a little bit away from that location, it takes longer for the temperature to go up. For example, let's say you are ablating right on top of the esophagus, but your temperature probe is a few centimeters away. The problem with this is that the temperature in the temperature probe will go up, but by the time it goes to 39 degrees there, it would be much, much hotter in the other location closest to the ablation catheter in the esophagus.

In your experience, does the CIRCA S-CATH enhance your ability to treat your patients safely?

I think so. It's hard to prove this, though, because AE fistula formation is not a very common thing. However, what I can tell you is that when we do endoscopy after using the CIRCA S-CATH, we have only rarely seen ulcerations in our patients. So because of that, we believe that this is working quite well.

What other methods do you use to minimize heating of the esophagus? For instance, do you modulate the power settings when you ablate on the posterior wall? What power settings do you use?

Yes, on the posterior wall we keep the power less than 25 watts, so that is one way to minimize the amount of ablation. By the way, if we do heat up the esophagus, obviously we stop ablating, but when we go back to continue ablating (because eventually we have to ablate that location), we use less energy — often we use 20 watts, even 15 watts or 10 watts.

When you are ablating near the esophagus, how rapidly can you see temperature rise in patients?

It can be extremely quick – within 5-10 seconds you can exceed 39 degrees in some of the situations.

Does epicardial fat play a role in the transmission of temperature to the esophagus?

Probably, but most of the time with the locations we're talking about, there is unfortunately not that much epicardial fat. There is some when you go more inferiorly and more superiorly, but just on the posterior wall there tends to be relatively little epicardial fat.

Do you identify the position of the esophagus before you begin ablating?

Yes, use of the S-CATH shows you exactly where the esophagus is on X-ray.

Does having better knowledge of the location of the esophagus change the way you ablate elsewhere in the left atrium?

It does in some sense. For example, if you have a situation in which the esophagus is in a certain location, you may decide how wide of an isolation you want to do just to minimize the heating of the esophagus. Therefore, it does have some impact.

Are there situations where you attempt to move the esophagus away from the site of the ablation?

There are ways to move the esophagus away; however, none of these approaches are FDA approved. However, we're doing a study to look at this.

What benefits does your use of the CIRCA S-CATH provide?

We believe it allows us to safely do AF ablation in an efficient manner.

Disclosure: Dr. Reddy has no conflicts of interest to report regarding the content herein. Outside the submitted work, he reports stock/stock options with CIRCA Scientific, LLC.