EP Lab Digest 20 YEARS

A product, news & clinical update for the electrophysiology professional

EP Lab Spotlight

Memorial Hospital of Carbondale

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Memorial Hospital of Carbondale is the largest tertiary healthcare system in Southern Illinois, covering 16 counties in the local referral network. With the partnership of Southern Illinois Healthcare (SIH) and Prairie Heart Institute (PHI), we have provided comprehensive cardiovascular care for Southern Illinoisans for decades. The hospital is a semi-academic facility with a strong affiliation with the Southern Illinois University (SIU) School of Medicine, providing the clinical training site for the family medicine residency program and first-year SIU medical school; our electrophysiologist also mentors and supervises medical students from SIU School of Medicine.

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Cover Story

A Novel Sinus Node Sparing Therapy for Patients With Intractable Symptomatic Inappropriate Sinus Tachycardia: Case Study and Insights From the SUSRUTA-IST Study

Rishi Charate, MD[1]; Adnan Ahmed, MD[1]; Jalaj Garg, MD, FACC, FESC[2]; Dhanunjaya Lakkireddy, MD[1]
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Inappropriate sinus tachycardia (IST) is a cardiac dysautonomia defined as a resting heart rate (HR) of >100 beats/min, a mean HR of >90 beats/min over a 24-hour period, and an exaggerated response to exercise or stress with accompanied debilitating symptoms including palpitations, generalized weakness, dizziness, tremors, exercise intolerance, and presyncope.[1]

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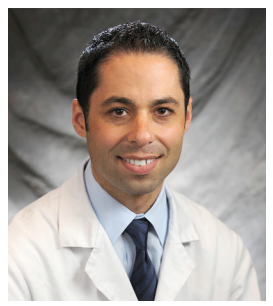
Podcast Interview

Advanced Lead Extraction Techniques: Current Approaches and Future Trends

Podcast interview by Jodie Elrod



In our next episode of The EP Edit podcast, we're featuring a discussion on advanced lead extraction techniques. Dr. Jonathan Salcedo, cardiac electrophysiologist with Silicon Valley Cardiology / Palo Alto Medical Foundation (PAMF) - Sutter Health, is joined by Dr. Robert Schaller, Director of the Cardiac Lead Extraction Program at Penn Medicine, to discuss their approach to lead extraction.

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Advanced Lead Extraction Techniques: Current Approaches and Future Trends

Podcast interview by Jodie Elrod

Jonathan Salcedo, MD

Robert Schaller, DO

Jonathan Salcedo, MD: I'm Dr. Jonathan Salcedo, cardiac electrophysiologist with Silicon Valley Cardiology, which is a part of the Palo Alto Medical Foundation and Sutter Health in the Bay Area. Specifically, I'm practicing at Sequoia Hospital in Redwood City and Mills-Peninsula Medical Center in Burlingame, California.

Robert Schaller, DO: I'm Dr. Robert Schaller from the Hospital of the University of Pennsylvania. I'm the director of cardiac device implantation and extraction, and I've worked here for about eight years now.

Salcedo: Thank you for joining me today, Rob. This is really a great opportunity and I'm looking forward to this. I remember when I first joined the Twitter platform in early 2018, your account was one of the first ones that I started following because of the great examples of lead extraction that you would present, and I quickly realized how powerful of a sharing platform it [Twitter] was. I distinctly remember one of my first cases that I wanted to ask a question about was on simultaneous lead traction, which I had to figure out on my own because of a difficult case. You were very gracious and commented on my post, saying "This is a great example of this, and stay tuned because we have work coming out on it." Lo and behold, a few months later you had that great Heart*Rhythm* journal publication, which is one of my favorites to reference to when I talk to patients about our technique that I employ here at Sequoia and Mills-Peninsula. So, one of my first questions that I want to ask is, how did you come up with this idea and when did it all start?

Schaller: The lead extraction world is small indeed, so it's always nice to bounce questions and cases off of each other. You were one of the earlier adopters of the technique that we now like to use, so that's always nice to hear. The simultaneous traction strategy came about 10 years ago when I was working as a fellow. One of my former mentors was Josh Cooper, who is now the Chief of EP at Temple. We used to do cases together and he would tell me that when he pulled a lead from above, he thought he was pulling some tissue from the superior vena cava (SVC) into the extraction sheath, if it was in fact attached. Of course, you have to pull relatively hard from above in order to establish a rail that is strong enough. He used to think that theoretically, if it was attached, perhaps some of that tissue would go into the lead tip and even more so if you used an oversized sheath, and you might envelop some of that tissue. That is actually one of the reasons why we typically use an appropriately sized sheath. Having performed these procedures with simultaneous traction from below in cases of occlusion and the lead is coming out, and you have to keep the lead in place, we noticed a couple of things. We noticed that simultaneous traction tended to stabilize and mitigate some of that traction from above and equilibrate it. In doing so, it would make the rail lead that much stronger and it would also pull the lead away from the SVC, and make it more parallel to the SVC. So it seemed like when we were using traction from above and below, only good things happened to the lead, and it seemed that it separated from the wall, making SVC injury less likely. It was those conversations where simultaneous traction was really born.

Salcedo: That's awesome. I remember when I was in training and going through the fellows circuit, Seth Worley would always say of his complex biventricular (BiV) implants, "Once you have a strong rail, you can deliver anything, anywhere." That resonated with me when I first started doing this technique. It just felt, like you said, that you're guiding the sheath more towards the right atrium (RA) and saving that lateral wall of the SVC. Certainly, there have been times on fluoro where you just see that lateral wall release — the whole lab just breathes a sigh of relief.

Intuitively, it just made sense. But what I found really remarkable about your paper was your use of intracardiac echocardiography (ICE) imaging to really define that cleavage plane. I think that really drove home the point, at least to me when I was reading the article, that this is really changing or at least helping that cleavage plane stay in the true track. That being said, what tools do you employ most often when you're doing this technique?

Schaller: The tools can depend on what you prefer and your expertise in the region you're working in,

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because some of this you have to make up as you go. The whole concept of enhanced rail strength is definitely important. As you said, it's very helpful when putting sheaths in and taking leads out. I'd be remiss not to mention that this concept of simultaneous traction wasn't necessarily invented only by us. It was invented independently by a couple of people — namely, Seth Worley and Roger Freedman — but we were the first ones to try to gather some data. We knew that the theory was probably sound, but in order to convince ourselves and others, we had to get a little bit of data, and that included fluoroscopic and ICE guidance as well. When we're doing a procedure, snaring the lead isn't so easy. Our setup is such that we have a protocol where we use many femoral access points, at least four or five. The left is reserved for ICE, as well as the Bridge occlusion balloon (Philips). We like to leave that side alone and if we need a pacing quad, we'll put that in the left as well. We use the right side solely for percutaneous extraction, particularly if we think we're going to need it (eg, younger patient, older lead, dual-coil ICD). There aren't too many options, as you know, to snare a lead, and it can be very frustrating. The tried and true option, the one that has been around for a while, is the Needle's Eye Snare (Cook Medical). The benefit of the Needle's Eye Snare is that if you're able to grab the lead, it's a very strong tool, so that lead isn't going anywhere and you could pull it as hard as you want without the lead sliding. But it can be challenging to grab the lead with the Needle's Eye Snare. Sometimes it's more helpful when you put it into a deflectable sheath, if you can find one that size.

In the beginning, we quickly moved to a different strategy that we describe in the paper, which is taking a deflectable decapolar catheter, draping it over the lead, and then, from a separate access point or the same sheath, if a big enough sheath is used, we will snare the tip of that decapolar catheter. The benefit is it's relatively easy to do; the downside is it doesn't give you as strong of a grip on the lead — it can slide from one side to the other. But all in all, that typically is our way to snare a lead.

Salcedo: So, if you do send it through the same sheath, what size sheath do you use?

Schaller: It doesn't need to be too big; it just has to take a decapolar catheter, which could go into a 7 French (Fr) sheath, and a snare, which I think requires a 6. So, anything in the order of 14. Something like that sounds big, but we use 16 and 20 Fr sheaths all the time. If you require deflectability in that sheath, it becomes a little bit harder to find.

Salcedo: Do you ever need a deflectable sheath when you're using a decapolar and snare technique?

Schaller: We will typically use two separate sheaths. We'll send a decapolar catheter up, pretty much naked, through a small sheath, and we are able to drape it over very easily. It's the snaring of that tip of the decapolar that is challenging. That's why we send the snare through a deflectable sheath, and 9 times out of 10, we're able to grab it.

Salcedo: That's a really good tip. Personally, I have used more of the Needle's Eye Snare, like you mentioned. It is nice that it's an all-in-one sheath, and once you grab it, it provides that super strong control over the lead. Once you lock it down with a soft-grip hemostat, it really doesn't slide or move. But like you said, it's a learned technique and there have been maybe two or three times where we really just could not get enough angle on the lead, because the lead may have been tacked down a little more laterally. I haven't used the decapolar technique quite yet, but I'm getting my lab set up to have some on hand just in case. Hearing your experience, I think it will be a good tool to have in our back pocket. And what you mentioned with a steerable could definitely help. Using the curved inner sheath and outer sheath options that come with the Needle's Eye Snare have helped a lot to be able to cant in a certain direction and try to interact with the lead somehow. Usually, once you start interacting with the lead, it becomes much easier. I think having both techniques at your disposal is probably the smarter way to approach most of these cases. In terms of equipment, there are a lot of hands that need to be on these tools, so how do you manage all that? Do you do it all yourself, or do you have assistants or fellows in your cases?

I haven't used the decapolar technique quite yet, but I'm getting my lab set up to have some on hand just in case. Hearing your experience, I think it will be a good tool to have in our back pocket.

Schaller: Every lab is different and you use what you have. The last time I checked, you were doing these with a partner. That's an incredible resource to have, an opportunity to have someone there with expertise and to give you some extra confidence and another set of eyes; that is so invaluable. I hope you realize how lucky you are to have that, and I'd love to know more about how you actually make that happen. We don't have the benefit of having a second attending, but we do have very skilled fellows that are quite dedicated to extraction. At the University of Pennsylvania, we do a ton of complex ablations like you guys do as well, so many of our fellows are steered towards those labs, and there are usually a handful of fellows who are interested in extraction. As you know, if somebody is interested in extraction, they're generally very interested, so they become allies in the lab. We don't have scrub techs or nurses that scrub in, but we have one fellow for every case, and we'll typically do the case together. So we'll start at the groin and place all of the sheaths, and then we'll try to snare the lead. We give the fellow every opportunity to do all portions of this procedure, which is commensurate with their experience, but there certainly is a steep learning curve.

After we snare the leads and we place ICE, the Bridge balloon, and any other tools that we'll need, what we'll typically do then is cover the entire femoral portion of the prep with a separate sheath. We affectionately call it a "cummerbund" sheath because it looks like a cummerbund, and then you drape it over the groin. That becomes less important if it's an infection case, because your sterility isn't terribly important in those cases. So we'll generally keep it open, but if it's sterile, we're very specific about that setup and we try to keep it as sterile as possible. Once we're done with the groin, we will re-scrub, re-gown, and then go to the top. We'll then work together at the chest. When it comes time to utilize simultaneous traction, if we're going to — and we typically do that on dual-coil ICD leads or any lead that we think or are actively using power on the SVC or using aggressive techniques in the SVC — one of us will break off, come to the bottom, and then provide traction from below. Sometimes that's me, and sometimes it's our fellow. As long as you're working in tandem and you know what the other person is doing, usually it goes pretty smoothly. How is that compared to what you guys do?

Salcedo: It's very similar in terms of the sterility issue. We actually have a separate table set up on the other side of the patient for the femoral stuff, and we keep syringes and needles all on that side. A separate table on the patient's left side, since most are for left-sided devices, is for the pocket and lead locking stylet, and stuff like that. So between myself and Amir Schricker, who is my colleague at PAMF, we do all these cases together and have a block day at both hospitals once a month. We alternate: basically whoever's primary patient it is, that physician will do the work with the pocket and preparing the leads, while the other assistant physician will start with the groin access. So it's really nice having the simultaneous prep, because it saves time. By the time the pocket is prepared and the leads have been tied up, usually the operator at the groin has gotten a hold of one of the leads and is pretty much ready to go. So that really saves time doing it in parallel instead of sequentially.

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It's important to realize it's not the room that is going to save a patient's life if needed. It's not the fact that there is a certain ventilation system or a certain bed to lay on, it's the people and the preparation.

Basically, that's also how we keep sterility — that operator has their own scrub tech and they usually will operate the panning and everything with the fluoro. In terms of which cases, we decided early on to employ this on any lead, regardless if it's an ICD or pacemaker older than two years, where we suspect that we'll have some kind of binding site in the SVC. It makes it interesting when you have two or three leads that you're going after, which lead you end up snaring first. So that's why it also helps to have that second operator there, because once you're done with one lead (ie, past the SVC), they (the snarer) release it while the other operator is still working on the tip of the lead in the RV, and then they can actually move towards the second lead and get that snared up.

Schaller: That's like a well-oiled machine that you have in your lab. Doing all that snaring really is excellent practice with very little downside.

Salcedo: Exactly. That was partially the selfish reason for saying upfront, "Let's just do it for any case where we know we're either using energy or a cutting tool," because like you said, it's a steep learning curve, but both Amir and I are relatively quick about getting things snared now. There are rare instances where the lead is tack down laterally and neither of us can get it, but I'd say in over 90% of the time, we can get it within 5 to 10 minutes. It is a nice workflow and in terms of block times, it takes a while. As you know, with OR and anesthesia and working on both physician schedules, it takes time to develop that. But once we realized we were getting more referrals, both hospitals were willing to give us a block day, and now we have it streamlined in our clinic. So once I book something, it's put on his schedule and we know that those days are our dedicated time. It took a while, probably about a year, to figure all that out, but once we got it done, it has become invaluable to have another practitioner's mind to bounce ideas off of or to have that second set of eyes. We frequently stop each other and say, "Wait, let's just take a second and think about this." So I think we've enjoyed that aspect. As you know, it's rare to work with a fellow EP partner or faculty member in the same case, right? You're usually training fellows or you're just practicing on your own. So it has also added that camaraderie and team aspect back to the lead extraction program, which for us, is most important.

Schaller: That is a really enviable workflow. I think another benefit to snaring every ventricular lead is that it protects the tricuspid valve. In the last couple of years, something I've become much more interested in is whether we have acute or subacute injury to the valve. A lot of that is just from pulling and the lead coming out prior to the sheath reaching the valve. Some of that probably has to do with implant technique and whether it's resting on a leaflet or through a leaflet, or through a cord. I think the only way that I know to protect the valve is to get whatever power sheath you are using through the valve. If you're buffering all of that traction from above with a snare from below, that sheath is more likely to get down to the valve. So my guess would be that you're going to have fewer tricuspid valve injuries utilizing that technique.

Salcedo: That's a great point, and that's something all of us are aware of and we always check the tricuspid regurgitation (TR) before and after. I agree with your point, and a lot of times, the lead will just come out from the upper traction. That brings me to another question about your equipment. I know you love ICE, and you've mentioned it before on Twitter and in your talk. So do you use ICE on every case? Are you always looking at the valve? How do you use ICE during a case? What's your workflow?

Schaller: We were early adopters of ICE during lead extraction cases because we use it for all of our ablation cases — most people do — so we thought it made sense. We didn't exactly have transesophageal echocardiography (TEE) ready to go for every single case. Also, I don't particularly like when there is a huge TEE probe right in the middle of the screen and overlying the SVC. So we started to use ICE and learned a lot very quickly, and we now have a protocol and have written a few papers on how to use ICE. Basically, we use it for risk stratification as we're able to see, to some degree, adhesions of the lead to the myocardium, particularly the tricuspid valve and the papillary muscles of the tricuspid valve. That has changed our strategy a couple of times. We're also able to see if the lead is attached to the SVC sometimes. Pulling on the lead a little bit while you're looking will sometimes give you a better idea, because you could see the SVC moving with the lead. So that certainly tells you whether the lead is connected or not. If you see the lead freely floating in the SVC, then I don't think you really need simultaneous traction because you know the risk is really low. We use it to monitor complications in general, but after our initial survey, while we're at the groin, what we do is park it in the right atrium to look at the tricuspid valve. Since the cummerbund sheath is on top of the ICE catheter, generally we will be able to rotate it left and right with our left hand through the sheet, but we really can't maneuver too much.

Salcedo: Right.

Schaller: But you can't really look at the SVC in real time, because it comes out of plane. So we choose to look at the tricuspid valve, and during the procedure, during varying degrees of traction and pushing the sheath, we sometimes will see traction of the lead attached to bad places like leaflets or chords or papillary muscles. That will sometimes make us either completely stop what we're doing, change our degree of traction, or even change tools. So I think intraprocedurally, dynamically, the tricuspid valve lends itself to monitoring with the ICE catheter.

Salcedo: That is something that we will probably adopt from your practice relatively soon. I wanted to pick your brain about that — it's a great use of the imaging. So does that mean you don't actually employ TEE at all during cases? You just use ICE?

Schaller: I have never used TEE during a lead extraction case. I think TEE is great, it takes a dedicated person there, but again, it can get in the way. It has not been shown to be able to identify adhesions and it probably doesn't image the tricuspid valve as well. Listen, you use what you have, and you use what you're comfortable with to keep the patients safe. I think ICE has some significant advantages.

Salcedo: That is a great tip and we'll definitely look into using that. We have TEE on every case, and like you said, sometimes you just can't quite tell which lead you're on or which lead you're seeing. I ultimately just have them park it to look at the four chambers and make sure there is nothing growing in terms of an effusion. But it doesn't add to the actual process while we're coming down the lead, like your ICE technique does. So I think that's a great tip, and if you guys eventually publish data on that, that would be wonderful to learn from. In terms of safety and the potential catastrophes that can happen, in terms of room use and backup with CT surgery, do you always have OR backup or in the control room, or scrubbed in with you? Also, is this always happening in a hybrid cath lab in the OR or are some cases done in an EP lab setting? I'd love to hear your thoughts on that.

Schaller: It's wonderful to work in an operating room environment or a hybrid operating room, but as you know, resources are limited and it's difficult to get space in those labs when other service lines are very busy as well. As you know, some of our cases are unpredictable and they need to go in as soon as possible. We work in the EP lab only, but it's important to realize it's not the room that is going to save a patient's life if needed. It's not the fact that there is a

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certain ventilation system or a certain bed to lay on, it's the people and the preparation. So even though we work in an EP lab, we have every single tool that we would possibly need to rescue a patient. We have a lab staff that is well versed in how to prepare and use these tools, as well as what a complication might look like specifically in an SVC laceration or other vascular problem. And of course, we never start a case until we know that we have a cardiothoracic surgeon who knows about the case and is minutes away if we need him or her. They're wonderful surgeons, and they understand lead extraction and the complications that can arise from them. With that being said, avoidance of complications is much more appealing, and it's a desire to not utilize their services that kind of spearheaded so many of these techniques that we've developed.

Salcedo: So if an injury is detected, your workflow probably would be to deploy a Bridge balloon to hopefully buy you time, and then, is the surgeon and staff prepared to transfer the patient to an OR room in that situation?

Schaller: As you know, it's crucially important not to augment the patient's blood pressure when you think that you might have an injury. So you really have to see how things settle out, because you don't want to mask an injury. Like you said, the first thing that you should do is just inflate the Bridge balloon without even thinking about it. In parallel, what we do in those situations, at least when we practice these drills, is to immediately set up a thoracotomy table and tray, including the saw, as we're calling the surgeon. The goal is to rescue that patient in the exact same room that you're in. I think it can be foolish to move the patient. First stabilize the patient and then, if needed, you can certainly move the patient to the OR. That's why the Bridge balloon has become so important to us. It buys you those extra 5-10 minutes, it stops the chest from filling up with all that blood, and gives your surgeon a chance.

Salcedo: I've heard from other operators about their battles with OR block time and whether it's safe enough to do these cases in an EP lab. I think your experience will be so valuable for them, because they're frequently unable to book cases and end up having to send them out when they probably could have done them at their own institution. But I think the more these data come out, and I know there are a few other centers that are talking about risk stratification scores and things like that, [the more it] will justify doing these in the EP lab. Overall, I think that will help the many other extractors in the country, so it's great to hear your experience. Rob, I

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really appreciate you being available to meet with me today and loved hearing your insights on this crazy procedure that you and I love to do.

Schaller: Thanks so much for having me! You're always one of my favorite people to talk to, because we have very similar practices. It's good to know that there is some simpatico here. We understand how difficult these cases are. Keep doing the great work that you're doing.

Salcedo: No doubt. And for all the listeners, Dr. Schaller is on Twitter, so follow him on there. He has some great pearls of wisdom that I've definitely used over the years. It's @rdschaller.

RS: And @50wattdoc. Thanks so much! ■

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