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Focusing on Real-Time Catheter Tip Confirmation for Central Lines

Announcer:

This is ReachMD, and you're listening to *Vascular Viewpoints*, sponsored by Becton Dickinson, advancing the world of health.
Here's your host, Dr. Amy Mackey.

Dr. Mackey:

Over the last five years, PICC catheter tip positioning and confirmation using electrocardiogram or ECG has become the standard of practice in the U.S. and is being broadly adopted globally. These technologies have been shown to reduce the time to therapy, eliminate the need for confirmatory chest x-rays, and reduce the cost associated with these procedures. But could this technology also be beneficial for use with acute CVCs placed in the internal jugular veins or subclavian veins?

This is Vascular Viewpoints on ReachMD. I'm Dr. Amy Mackey and with me are Dr. Salim Rezaie, and Dr. Evan Alexandrou. Dr. Rezaie is Staff Emergency Physician and Director of Clinical Education with the Greater San Antonio Emergency Physicians Group. He is also founder and editor-in-chief of Rebel EM, a bench to bedside blog covering evidence-based clinical topics in emergency medicine. Dr. Rezaie, welcome to you.

Dr. Rezaie:

Thanks for having me. I'm excited to be talking about some central vascular access technology and updates.

Dr. Mackey:

And Dr. Alexandrou is a senior lecturer with the School of Nursing and Midwifery at the Western Sydney University in Australia. He serves as a clinical nurse consultant in the intensive care unit at Liverpool Hospital where he coordinates the central venous access service which happens to be internationally renowned for its clinical expertise in vascular access and procedures. Dr. Alexandrou, great to have you with us.

Dr. Alexandrou:

Thank you very much for inviting me.

Dr. Mackey:

So Dr. Alexandrou, let's jump right into it. As I understand it, you are a leading figure in some of the initial research evaluating this technology's accuracy and efficacy. To help level set, can you give us a quick review of how this technology works?

Dr. Alexandrou:

Certainly. So, ECG itself has been around for many, many years, and placing electrodes on the skin allows us to pick up some of the heart's electricity, I guess, and we're able then to map that on metric paper. Essentially, what we do with intracavitary ECG is very similar, except one of the electrodes is actually connected to the catheter and, instead of having a static electrode, one of the, uh, on of the leads is actually mobile and as it heads towards the heart, the signal, uh, increases in amplitude and, as we head towards the atrium and head towards the sinoatrial node, the peak wave amplitude increases and, um, where we have the most maximal P-wave the catheter essentially sits on top of the heart or what we call the cavoatrial junction and, um, is essentially where we want that catheter to terminate.

Dr. Mackey:

And what are some of the benefits of having the acute CVC catheter to tip in the appropriate place in the cavoatrial junction?

Dr. Alexandrou:

Well, we know from, um, previous studies and also from clinical cases that, um, a catheter that doesn't terminate deep in the cavoatrial junction or the upper right atrium, uh, can having, um uh, issues with performance of the catheter. So, for example, we may get some, umh, inappropriate flows, um, if it is a heart flow dialysis catheter. Um, the higher up the catheter, um, terminates, up towards the, um, middle of the superior vena cava or perhaps, um, for example, if it is a catheter coming from the left side, um, heading towards the, um, the superior vena cava or if it's terminating close to the, um, junction of the, um, the brachiocephalic vein in the superior vena cava, uh, you can get significant thrombosis.

Dr. Mackey:

So you've already addressed some of the risks associated with malposition. Are there any other issues or liabilities that you want to talk about if an acute CVC catheter is malpositioned?

Dr. Alexandrou:

Oh, certainly. Depending on the medication that you're also, um, administering, um, if it's, um, if the catheter is, uh, inappropriately placed and typically, you know, if the catheter is malpositioned in terms of, um, too high or, you know, if you're placing a CVC from the say the auxiliary, um, or subclavian approach and you have a, um, a contralateral, um uh, placement so the tip actually moves across to the other side or sits, um, curls in the brachiocephalic vein, um, when you're giving vasopressors or high osmolar medications, again, that can cause significant, um, issues related to thrombosis, um, and, um uh, other complications with the device. And it essentially affects the performance of the device too, so, you know, if you've got a patient who is requiring, um, significant vasopressors, if you have a device that's not, uh, performing appropriately then, um, the ability to, um, stabilize that patient and provide appropriate, um, dosing of vasopressors can be, um, can be affected as well.

Dr. Mackey:

Okay. Turning to you now Dr. Rezaie, given you're an emergency physician who has uniquely tapped into the pulse of your field, can you touch upon some of the use criteria and types of procedure for which this approach to catheter tip positioning has been most impactful in the emergency setting?

Dr. Rezaie:

Well, speaking of vasopressor infusions, I would say that the critically old patient who is hypotensive, when we place these central venous catheters into the internal jugular or subclavian vein, um, waiting for a chest x-ray or ultrasound to confirm the placement of that catheter just has never made sense to me. The procedure itself takes some time but then you can't use that line until you've confirmed that it's in the right place. And so, this technology seems to alleviate that issue by confirming placement of the catheter and making sure it's in the right place in real time.

Dr. Mackey:

And staying with you, Dr. Rezaie, how beneficial would it be to know the tip is in the right place before you suture the catheter in place?

Dr. Rezaie:

So, this really takes care of two things; this technology does. So, number one is now that I know that my catheter is in the right place as I'm doing the procedure, I can actually begin using medications before the catheter is ever sewn in. And then the second thing I would say is, we don't have to sew in a catheter, wait for an x-ray, 'oh my God it's in the wrong place,' now I've got to cut the sutures, reposition, get another x-ray, confirm again. So, this gets rid of a lot of extra steps and precious time for the patient.

Dr. Mackey:

Dr. Alexandrou, I want to come back to you in your capacity as a clinical nurse consultant in critical care. How should vascular access placers in ICU settings incorporate this technology into practice protocols?

Dr. Alexandrou:

I think the benefits of intracavitary ECG outside of vascular access teams, so, in areas such as, you know, other areas particularly critical care, so, you know, the emergency room, the operating room or intensive care, um, it provides the benefit of being able to, uh,

confirm the tip of the catheter real time. And so, you're able to then use that catheter, uh, with confidence so you can give, uh, the patient the vasopressors they required and, um, full resuscitation that, um, is required for that patient as well. One of the other added benefits of intracavitary ECG is that once you've placed that catheter and you've confirmed the position, you're able to place that dressing, uh, on the catheter and you're reducing the risk or the need to interrupt that dressing afterwards. Because every time we interrupt that dressing, we're increasing the risk of, uh, infection essentially.

Dr. Mackey:

And are there certain departments such as ORs, ICUs, or EDs that would benefit more or less from this type of technology?

Dr. Alexandrou:

Oh, absolutely. There are, uh, a number of areas as we said, you know, um, whether it be, uh, emergency, anesthetics or intensive care. These are areas that don't routinely use intracavitary ECG and so, for them, they'd be able to place these, uh, catheters, uh, and be able to, uh, confirm the catheter tip real time and, again, be able to use that catheter with confidence.

Dr. Mackey:

So, Dr. Rezaie, we've been speaking about some of the clinical impacts seen from this technology but I'd also like to get a sense of the continuing challenges clinicians face around these procedures. What can you tell us about this?

Dr. Rezaie:

Yeah. So, there's four points that kind of came to my mind that I wanted to kind of touch upon. Some of this is, uh, just researching on this technology in regards to central venous catheter placement and some of it is just, uh, videos that I've even watched from the website itself. So, the first thing I was going to say is that, uh, as Evan had stated earlier on, that we're looking for changes in the P-wave on the monitor with this technology and so I thought this might be an issue with patients with atrial fibrillation. So, that's the first point I want to touch on. The second is, there's another category of patients we see in the emergency department all the time and these are patients that have pacemakers. And, it looks like in a lot of studies these patients are excluded or they're atrially paced and so I'm not sure how this technology would work or not work in that patient population. So, I'd like to see more studies on that. And then the next thing I would say is central venous catheters, they're a sterile procedure. So, if someone's going to use this technology, they're going to have to plan ahead, place the device ahead of time, so that they can put a sterile drape over that and ensure that they're putting this line in in a sterile fashion. And then the fourth and final point is, regardless if using this technology or not, there's going to be complications from the procedure itself such as pneumothorax. And, you would still need a chest x-ray to be able to see if you caused a pneumothorax while you were doing the procedure. But, at least I know my catheter is in the right place and I can begin medications that the patient needs. So, those are the four points that I just kind of wanted to touch upon when you talk about difficulties with this technology in terms of central venous catheters.

Dr. Mackey:

Dr. Alexandrou, the technologies confirm the tip location but as Dr. Rezaie had commented, they don't provide information regarding pneumothorax. Do you believe a chest x-ray is still required to rule out this complication or can a lung-sliding, um, ultrasound be used to check for pneumothorax?

Dr. Alexandrou:

Um, yes. I think if you're competent enough, um, using your ultrasound for, um, looking for the sliding of the visceral or parietal pleura, um, for that sliding lung slide, as you said, um, it is as effective, um, as, um, a chest x-ray. And some people say, you know, um, for small pneumothoraces, an ultrasound is, in fact, more sensitive than a chest x-ray. Uh, in saying that, um, you know, if you're not confident and if the patient seems to be, um, having, you know, displaying signs and symptoms of a pneumothorax then, of course, you can still get a, you know, chest x-ray. I mean intracavitary ECG or the method of using intracavitary ECG does not necessarily mean that you completely remove the need for x-ray. Um, of course, you can still use it, but you may, you know, 90 to 95% of the time or, in fact, when you look at the studies, 99% of the time you're not going to require a chest x-ray whether you're placing a peripherally inserted central catheter or a centrally inserted central catheter.

Dr. Mackey:

Great insights and thank you. Doctors, we're coming to the end of our program but, before we go, I'd like to get some closing thoughts from each of you on the current and future roles as you envision them for support of vascular technologies such as this one. Dr. Rezaie, let's start with you.

Dr. Rezaie:

Yeah. For me, it's simple. Technology is just amazing. The things we can do today that we couldn't do 10 or 20 years ago is absolutely amazing and the technology I'd like to think of is ultrasounds. I think of ultrasound as stethoscope 2.0. I can't remember the last time a stethoscope changed my management of a patient but I can certainly remember hundreds of times an ultrasound has. And this is basically the next evolution of that. I look forward to seeing more technology to improve the care we provide for patients. But also, I want to make sure they look for negative affects that this technology could also give to our patients as we introduce more tools into the toolbox.

Dr. Mackey:

Thank you. And Dr. Alexandrou, your thoughts?

Dr. Alexandrou:

I think, you know, technology such as intracavitary ECG has revolutionized, um, what we do the same way as Dr. Rezaie says, when ultrasound first became available as, you know, point of care, um uh, use, you know, we were able to change how we practice. We went from placing, you know, catheters blind to being able to visually, um uh, see the needle tip, um, entering the vein. And this is just that next step where, you know, by using, um, intracavitary ECG, you know, we're able to visualize that catheter tip, um, heading towards the cavoatrial junction. So, I think this type of technology, um, will revolutionize, um uh, vascular access in all facets of, um, clinical care

Dr. Mackey:

Well those are great takeaways to keep in mind and I'd like to thank my guests, Dr. Salim Rezaie and Dr. Evan Alexandrou for joining me today to talk about the present and future applications for tip confirmation technology in vascular access care. Doctors, it was great having you both on the program.

Dr. Rezaie:

Thank you for having me on.

Dr. Alexandrou:

Thanks.

Announcer:

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