

ECG Education – Where Are We and Where Do We Go

Announcer: Welcome to Mayo Clinic's ECG Segment: Making Waves, continuing medical education podcast. Join us every other week for a lively discussion on the latest and greatest in the field of electrocardiography. We'll discuss some of the exciting and innovative work happening at Mayo Clinic and beyond with the most brilliant minds in the space and provide valuable insights that can be directly applied to your practice.

Dr. Kashou: Welcome to Mayo Clinic's ECG Segment: Making Waves, continuing medical education podcasts. Join us every other week for a lively discussion on the latest and greatest in the field of electrocardiography. We'll discuss some of the exciting and innovative work happening at Mayo Clinic and beyond with the most brilliant minds in the space and provide valuable insights that can be directly applied to your practice. Welcome to Mayo Clinic's ECG Segment: Making Waves. We're so glad you could join us today. Today we have an exciting episode planned for you as we step back and talk about ECG education. We will be joined by a physician and clinical educator in cardiology. So let's get started. To quote an article in the medical literature, it is difficult to imagine something more central to the practice of medicine than the performance and interpretation of ECG. Since its inception over 100 years ago, this simple, rapid, noninvasive diagnostic tool remains an important aspect of patient care across a variety of medical settings and specialties. In fact, it's reported that over 300 million ECGs are performed each year in the United States alone. And this does not include any of the new commercial devices now available to record and monitor cardiac activity instantaneously. Despite these tools' clinical importance and broad use, ECG literacy amongst medical providers is not common. This brings us to our focus today, namely ECG competency. Why is it not common? Has it had any consequences? And how do we revitalize this lost art? We will discuss all of this with one of our clinician educators in cardiology at the Mayo Clinic. Let me introduce you to today's special guest, Dr. Nandan Anavekar. Dr. Anavekar is a professor of medicine and consultant in cardiovascular in radiology departments at the Mayo Clinic in Rochester, Minnesota. He currently serves as the program director of the adult cardiovascular diseases fellowship program. He is board certified in cardiology and has completed additional fellowship training in echocardiography and advanced cardiac imaging. Dr. Anavekar has special interest in cardiac CT and MRI in congenital heart disease, cardiovascular physiology, with a particular interest in hemodynamics, as well as postgraduate education. His main clinical interest is in the management of diseases of the pericardium, diseases of the aorta, and critical care cardiology. Dr. Anavekar, what a true honor to have you today. Thank you for joining us.

Dr. Anavekar: Thank you, Anthony. It's really my greatest pleasure to be here. Thank you so much for this opportunity.

Dr. Kashou: No, it's such true pleasure. Well, thinking about your role as a clinical educator and what you've done not only in the ECG and beyond, I thought it'd be really important to have you here to discuss this important topic about ECG competency. And so, I guess to start with, maybe share a little bit of what your learning journey was in ECG skills and where that's come from.

Dr. Anavekar: Absolutely. And if I'm gonna be honest with you, where I started with my ECG learning was with a lot of fear and trepidation. When I first joined ECG as a medical student, it was all these squiggles, and I had no idea where to start. And in medical school, we have to learn so much in a very short amount of time. And the exposure that we got for electrocardiograms was very limited. And unfortunately, what that led to was a very goal-oriented approach to learning. The goal being to pass our professional exams. And so in order to pass our professional exams, what we ended up doing was to memorize a few of the patterns that we would've expected on our exams. So for example, atrial fibrillation, understand that it's irregularly irregular. If you saw something wide or complex on the ECG, and then we gave you a stem coronary artery disease, just call it ventricular tachycardia. And so that was the approach. And then when we didn't have to think about ECGs, then we'd bury that away for a while. So I have to say that unfortunately the first time that I actually seriously contemplated and learned about electrocardiograms was during residency here at Mayo, and during that too in my cardiology rotation. And I had a two-month block, and every day in the mornings, we would go through a few ECGs. And I could vividly remember many of the consultants, for example, Dr. Scott Wright, he would go through all the criteria for left ventricular hypertrophy, and every day he would mention it again. And then when we talk about ischemic heart disease, he would about the ST segments and depression versus elevation. And it was very systematically reproduced every day. And by the end of the rotation, I had a sense of confidence. But again, when I left cardiology rotation, there'd be a long span of time when I didn't practice the ECGs. And so there was a significant attrition. And I think that's really been the situation during internal medicine residency, and then again, in cardiology fellowship, again, we have that re-exposure to electrocardiography. So that's really been my experience. You know, obviously I still consider myself a learner of this art and learning from greats like you who bring a lot of value to the table has made it really a joyous journey.

Dr. Kashou: And so what I've heard is kind of early in your medical training, it was not easy, or at least there was, it wasn't sticking early on. But it was not until your residency training and during where you had that repetitive, everyday learning from Dr. Wright that it started to click, but we know, myself training here, that it's so specialized. So every month we're in a different specialty that you are learning for hematology, or you're learning for oncology or pulmonology, so the cardiology kind of falls at the wayside. Was it during the fellowship, do you feel like that's what kind of finally made it stick?

Dr. Anavekar: I wouldn't say that it's finally stuck for me because I still find that I'm learning something new. And true to your caliber, although you are a cardiology fellow at the moment and you consider yourself a learner, you are also an educator. And I find myself learning something new when you present some of the work that you're doing in electrocardiography and artificial intelligence, et cetera. What I think the biggest problem that has been for me personally, was the fear and trepidation that my first exposure to electrocardiography left with me. I think what has made it easier was having a very collaborative learning environment, and in that setting, always seeing an ECG of every patient. Now, being in the CCU, that's where I do a lot of my inpatient practice, every patient has an ECG, so I'm forced to review that. And it's made even better because I'm forced to review that with a group of learners. So yes, it sticks a lot better than what it used to, but I would argue that I still have a lot of sticking to do before I would consider myself anywhere close to being an expert.

Dr. Kashou: I hear you on that. Yeah, I think we're all learners. And I think it is that force yourself as kind of the lead provider on the critical care team and being almost tasked to not only be the expert on the team and lead the team, but as all learners, it kind of forces you because the patient care is impacted by that. You know, some would say that the current status of say the whole competency, that perhaps there's more that ECG literacy, E-literacy is more common than actual ECG competency. And I wanna ask you, what do you think is kind of the current status amongst, you know, yourself you have that personal drive to get better. What do you think just the general medical professionals and many, not only physicians, but say nurses and our other colleagues, what's is the current status and why do you think maybe that's where we are?

Dr. Anavekar: I think when you talk about competency, I think we need to describe it under two umbrellas: perceived competency and then true competency. And I think when we talk about perceived competency, when you talk to maybe a group of cardiologists or cardiology fellows, I think the perception is that we are competent in reading electrocardiograms. I don't know what the true competency is, but I would be suspicious that the true competency is much lower. And I think the result of why I think that's the case is because even a cardiologist's practice is extremely heterogeneous. If I'm in the echo lab, I might not need to look at an ECG for most of the day, if I'm looking in an echo. If I'm in the CCU and I'm managing a patient directly, I might not need to look at an ECG intensely for quite a long period of time. If I'm in the ECG lab, of course, that's where I will be sort of really concentrating on the electrocardiographic findings. So for that reason, I do believe that there may be a disconnect or a discordance between the perceived competency of our professionals versus the true competency. Of course, when you go to our nursing staffs, I think that discordance is a little bit less. I think our nurses do feel a need to become more competent in ECG interpretation skills. And I think that's more congruent with the true competency at that level. And I think, again, that discordance becomes lesser and lesser when you get down to the more foundational learner.

Dr. Kashou: Yeah. I think you're right. And, I think it, you know, as we educate, as we get further along this from medical school to residency, to cardiology, we almost feel like we're the experts, but I think that humble approach of realizing we're all learners here. And we're learners that have to keep learning to maintain that skill.

Dr. Anavekar: Yes.

Dr. Kashou: And not to shift focus because I think it's still on that perceived and true competency. You know, over the years, at least the last 30 years, we've kind of seen this revolution in technology. And you think of the mid 20th century when computerized interpretation really was integrated into the healthcare systems in which the goals were to improve clinical workflow, improve clinician interpretation and maybe to reduce kind of the burden. It seems like with all the technology now being introduced into medicine today, maybe we're becoming reliant. I don't know if it's sometimes good. Do you think, do you see any idea of how the computer, do you think it is impacting competency amongst providers?

Dr. Anavekar: Yes, I do. Overall, I think it's a great thing. I think we need to embrace technology. And I think at its root, it makes us more honest in the work we're doing. I think an

example where technology has really worked in an interpretive field is in the nuclear cardiology laboratory, where at Mayo, we actually practice with two readers: a cardiologist and a radiologist, but then there is the computer interpretation as well. However, we do our interpretation initially without looking at what the computer interpretation is. And then we fall back on the computer interpretation as an internal check. If there's disagreement, we re-review the data to see if we can explain that disagreement or not. And I think that's probably the best way to really collaborate with the technology. I think ECG interpretation has, from the technological standpoint, has just revolutionized our toolkit, and I think it can really help us treat patients who need expert expeditious care, and I think that we can only get sharper because of it. My only hesitation is that if we become too self-reliant on it, we decrease the competency of the human which allows for any potential technological errors to then become magnified. And I think the work that you're doing in artificial intelligence, I hope will bridge that gap and I hope that more creative educational strategies may also help bridge that gap to elevate the competency of our learners.

Dr. Kashou: Yeah. You do see that and I think you bring a good point up is, you know, we could talk about the software and how it doesn't maybe perform as well as we want it to, but does it perform better than maybe most providers, you know, as a cardiologist? Maybe it's not at your level, but should it be at your level. And I like your approach of using your own interpretation and then using the computer to say, "Hey, maybe did I miss or not think of something?" And there have been studies that, actually, if you present the same ECG to people and you give say a clinical scenario, the interpretations are different. So that makes a difference. But then also there's been evidence that if you present an ECG and give the computer interpretation, it actually affects and influences the clinician's final interpretation. And so the approach of, "Hey, I'm gonna interpret it based on my knowledge skillset," and then use the computer or this software "as almost a backup checker." I think that's probably, it seems like the best approach. And so, I guess aside from that, if we think back to medical training, you mentioned your story, are there areas in early training that we could do better?

Dr. Anavekar: Yep. I think that's a good question. And I think it gets at really a focal point in terms of how we define a learning environment. And actually, to answer this question, I think we need to really look back and we have to look back at ancient times in terms of how a learning environment was defined. In antiquity, what is required for a learning environment are essential components. The first essential component is a competent teacher or guide or instructor. The second component is a competent and qualified learner. So, competent qualified learner is one who has fulfilled the prerequisites to get to that next level of learning and who is invested in attaining the knowledge that's being delivered in that learning environment. The next thing is once we've established the learning environment, we have to ensure that knowledge is transferred from the instructor to the learner systematically so that we build on the knowledge and consistently over a period of time. So that's really the first major part of transferring knowledge. We have to understand that when knowledge is being transferred, the learner is going to have doubts. Doubts are gonna come up because doubts arise due to misunderstandings in the knowledge that's being transferred. So a learner should have an opportunity to raise doubts, to have questions, for which the instructor should be able to resolve. That's the second most important component of learning or knowledge transference. Then the final part, which in the ancient literature, they're called as sort of the meditative part or the contemplative part, the

learner should have the opportunity to practice. And that practice should also be consistent over a period of time. Because if you stop practicing, then we need to anticipate that there will be attrition in the skillset. And I think that is unfortunately the biggest problem that we have in our profession, especially since we're sort of spread so thin, that we are seeing an attrition in expertise. We are really enamored by our qualifications and our qualifications on a certificate. And we sort of magnetize to that, that we forget to practice those skillset consistently over time in order to maintain them. And so I think that's the solution. How to actually bring it to manifestation is a total other sort of discussion. But I think it can be done. And I think that if we have true creative educational innovators like yourself at the helm, I think it's achievable.

Dr. Kashou: It is fascinating you mentioned, you know, we always think of, okay, the learner, we want them to achieve competency. We expect the instructor to be at least competent in what they're instructing. But now you're saying the learner also has to be competent. Meaning they have to come in it with not only the right attitude, but the willingness to invest the time to learn that skillset.

Dr. Anavekar: Yes.

Dr. Kashou: And it's interesting how education is set up. And then you mentioned kind of the goal of the practice, of getting people there. And I think of your story of, in my story as well, where we go through all this training, but it's dedicated in single blocks, and we're expected kind of, like I said, drinking from the fire hose of learning all this knowledge that one important tool that's used every day could be forgotten. So the practice is very important. And like you said, there's a whole discussion of the instructor and the learner and how we actually deliver that content. Are there different ways? You know, how do we assess and measure? Or, any thoughts on delivery assessment or measurement of competency from that side?

Dr. Anavekar: The interesting thing about an electrocardiogram is that it's a finite amount of information on a piece of paper. There's a finite number of complexes. And there is a systematic approach to analyzing each and every complex. And I think that can be taught. I think we have to figure a way to carve out time in the day, no matter how short that time is, where we sort of deliver that not through a fire hose type of a maneuver but in a systematic way, from a teacher to the student. And that carved out time, we need to preserve it. And preserving that time, I think, is the challenge. How do we measure the competency after that? I think that's a brilliant question. Traditionally, we use tests and I think that there is always some value in testing a learner. But when we understand that the field is changing and we also have technology, I think we need to embrace a mechanism of measuring competency that also takes into account what the technology brings into the table as well. I don't have the right answer for that and, I think it requires a lot of thought, a lot of sort of contemplation, but most importantly, I think it requires a lot of collaboration from people who have succeeded, who have experienced a very positive learning sort of environment, a positive learning experience, and bring that experience and see if we can make that granular so that we can share it with a more broad array of learners.

Dr. Kashou: Sure. And again, the assessment of competency. And I didn't mean to put you on this spot, because even in some of the guidelines for our training as fellows, it's not defined.

You know, there's maybe recommended a number of halts but in terms of competency, it's not yet defined. And even if there is a certain number of ECGs to interpret, will it also, you know, you could go through all these ECGs in a one-month setting and then forget it just like where we work.

Dr. Anavekar: So, you can't hide your face from me, but you can hide your mind. Similarly, we can hide what we don't know. And I think that's the biggest sort of unknown in our profession. And in our profession, it's very difficult to say the words "I don't know" because it's seen as a badge of weakness. And I think once we get more comfortable saying, "I don't know but I am ready to learn" and "I want to learn" and "I want to get better," I think once we cross that hurdle, we'll be in a better place.

Dr. Kashou: Sure. Well, just one final question, you know, you've accomplished so much that I've seen you do over the years, and it's been over now three years, almost four. I guess, what career advice, or even personal advice, would you share for medical learners or in general?

Dr. Anavekar: I think the greatest piece of advice that I'd have is, in our profession, especially, not to take yourself too seriously. The first thing is humility. I think if you can come to work humble, you'll be ready to learn. I think that's the first thing. The second thing is to have an attitude of gratitude. You know, it's easy to complain about many things, and I should raise my hand up because I'm the first to complain, but I think when we look on balance, we have a lot to be thankful for in our profession and the opportunities that are in front of us. And then finally, to extend that attitude, to pursue every task with a sense of purpose, meaning that you give every task that amount of respect that it should be done with your best effort. I think when you do that, without the expectation of a certain outcome, you won't be left like a yoyo, moving from elation to disappointment, elation to disappointment. You will then really, I think, grow from the experience because everything we do from our profession, especially the medical profession, it's such an intimate privilege to look after the sick. It is an opportunity for us to grow and mature into better human beings.

Dr. Kashou: Thank you so much.

Dr. Anavekar: Thank you.

Dr. Kashou: Well, the ECG remains one of the most important tests in modern medicine and many medical professionals lack confidence with independent ECG interpretation. By further defining ECG competency standards for all health healthcare professionals, better understanding the existing gaps, and creating centralized, organized ECG curriculum for all learners and educators, we might improve the ECG literacy and revitalize this lost art. Dr. Anavekar, thank you so much for tackling this still unsolved problem, but something that deserves to be solved. You've been such a friend, a mentor, colleague, and a wonderful educator, not only to myself, but I know our fellowship program and everyone here. Thank you so much for all you did and on behalf of our team, thank you so much for joining us today.

- Oh, thank you, Anthony. It was my privilege and I would like to maybe just close by saying I think the conversation is probably more important than the outcome so thank you for letting me have this conversation with you today.

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