

## Challenges in Teaching ECG Interpretation

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. We're so glad you could join us. Today, we have an exciting episode planned for you as we discuss ECG interpretation education, which remains an important skill for medical professionals. We have an expert joining us who will give us his unique and experienced perspective on this topic. As one of the most performed diagnostic tests in modern medicine, the ECG remains a vital aspect of patient care across a broad range of specialties. However, teaching and learning ECG interpretation is not easy. Variability in ECG interpretation proficiency exists amongst medical professionals. In this episode, we will discuss ECG education teaching, including its importance and strategies that have worked for an educator in the space over the years. We're fortunate to have Dr. Kevin O'Brien with us today to discuss this. Dr. O'Brien is a professor of medicine at the University of South Florida Morsani College of Medicine. He received his medical degree from the University of Miami. He completed his residency training in internal medicine at Wilford Hall Medical Center in San Antonio, Texas in 1996, and has been an active internal medicine physician in the outpatient and inpatient setting at USF since 2002. Dr. O'Brien is the director of undergraduate medical education for the Department of Internal Medicine and the clerkship director for the Adult Inpatient Medicine Clerkship given throughout the third year of medical training. His interests include ambulatory and inpatient medicine, medical education of students and residents, and medical education research. He has been invited to give talks on a variety of educational topics regionally, nationally, and internationally. His research interests center around issues dealing with the evaluation and assessment, the learning environment, interpretation of common diagnostic studies, and physician and trainee wellness. Dr. O'Brien is a lifelong learner who believes that the best education is the place where truth and humility are both practiced and admired, as this leads to true inspiration. His interests outside of medicine include his faith, spending time with his wife, children, and family, music, and college sports. Dr. O'Brien, what a true honor to have you with us today. Thank you so much for joining.

Dr. O'Brien: Well, thank you for having me.

Dr. Kashou: You know, I'm always excited to talk about education aspect 'cause, you know, that's kind of where I think both of our passions align. And I know you teach a lot of topics, but maybe you can give our audience an idea of, you know, what topics you teach, who you teach them to, when and where, and, you know, how long you've been doing all of this.

Dr. O'Brien: I've been teaching EKG since 1996 and even longer than that 'cause I was doing it in residency training. And my mentor Chandra Mohan taught me how to read ECGs. And I'll never forget, I had a patient with dig toxicity who I correctly stopped the digoxin, but I missed the atrial tachycardia with a block. And he showed everyone the ECG on rounds and taught us that I missed it, but didn't say I missed it. And I knew that I missed it, and it inspired me to learn

even more. And my institution was very cardiology heavy and based, so learning ECGs was a very important skill in internship. You had to have all the written interpretations at the top of your ECGs in your writing and sign before rounds. So that was the impetus behind it. And once I learned how to read ECGs, 'cause I had a roadblock on figuring out axis, and once I figured out how to read axis, I just kept practicing and practicing. And I loved reading them so much, I started teaching them 'cause I noticed other people had the same issues as I did.

Dr. Kashou: It's really, you know, amazing. I mean, there's a few points there. Well, first off, it's our struggles that kind of lead to, you know, can we help others and give back in the way of our teaching of something we struggled with? But secondly, you mentioned kind of writing your interpretation on top. I know those days, you know, we don't have them really much anymore. Whether we rely on the computer, which some professionals do, and can lead to erroneous interpretations, or we're kind of reliant on more of the experts, you know, people like you to help us give the interpretation, and we kind of miss it. When you teach ECGs, what is the training level you're teaching to? And I know the clerkship is.... You know, why do you find so much passion and enjoy this so much?

Dr. O'Brien: Well, for me it's kind of like creating a light bulb moment for students, that it's very rewarding to actually see them make diagnoses by looking at, you know, a sheet of lines and figures and actually applying what they learned. So they're not just regurgitating facts, they're actually applying what they learned. So that's the exciting part about it. And I noticed when I came to USF that it was taught in the third year clerkship, but nowhere else. And there was no skin in the game. So they taught ECGs, but they never assessed it. And I sat there and I watched the discussion, and people went on screensaver 'cause they knew they weren't gonna be tested on it. And so they listened, and the person was, you know, enjoyable to listen to and was funny, but they really weren't paying attention. So back in about 2003, 2004, I created a competency exam in the internal medicine clerkship, and they had to interpret 12 ECGs. And what I tried to do is divide it up into subsections so it wasn't hard. So for the students, I did structural heart disease, and then I did arrhythmias, and then I separated out blocks from that, and then I did the ST segment. So they get a 12-item ECG exam with a history at the top, and then they have extended matching. So they have to pick from choices in each of those sections. So when they're in structural heart disease, they only focus on LVH, RVH, atrial enlargement. When they're in the dysrhythmias, could it be atrial, or could it be ventricular? And then in blocks it could be a variety of the different blocks. And then the ST segment it could be ischemia, it could be infarction, it could be pericarditis, it could be, you know, hyperkalemia. It could be a variety of things.

Dr. Kashou: Mm-hmm. You can hear it taught by a true educator knowing how to really refine the important aspects that we really want students to learn. I wonder, you know, what have you found as, you know, to be challenges in teaching it? I mean, you noticed a gap when you went to USF of the assessment component. And I would say it's not only USF, it's probably broadly across not only the US but internationally that we need more training. In your teaching, where have you found maybe some of the challenges that have arisen for learners to, you know, learn some of these things? And is there really a best way or a better way, you know, we should kind of adopt from you?

Dr. O'Brien: I think as I taught it in the third year, I said, you know, they need it more. So we have a critical care rotation in the fourth year, and I go, I teach in that rotation. And I actually give them the same exam and go over it with them. So they get it again in the fourth year. And then I said, "You know what, we really should be introducing it sooner." So I teach it in the first year, and in the first year, all I discuss is basic electrophysiology. So I explain why you see the waves and the lines that you see. And I talk about why is the P wave upright in lead one and inverted in AVR. Why there's QRS progression as we go from V1 to V4, V5, and v6. And then I teach them how to figure out rate. And then in the second year, I want them to apply what they're learning in their cardiac, physiology, and pathophysiology course, so now we introduce atrial and ventricular dysrhythmias, and we also do myocardial ischemia and infarction. So those are introduced in the second year, and then the third year I layer it on upon more that now they gotta recognize structural heart disease, now they gotta recognize blocks, and then they have to figure out other things that affect the ST segment besides ischemia and infarction.

Dr. Kashou: It's really interesting how how you've adopted, you know. And we've seen over the years how medical curriculum has changed in terms of maybe a system, a block approach. But you've, you know, taken this skill that, you know, maybe I'm quite biased, but it's probably one of the most important skills in medicine to be able to have. But you've taken it right from the start in the first year of medical training, like, okay, you have to at least familiarize yourself with some of the basics, the fundamentals, and build on it throughout. And it's that longevity, almost that translational teaching that you're doing, that's really amazing. And I hope other programs kind of hear this and adopt a similar manner of teaching. I wonder what your thoughts are, and you can certainly add to this, but of ongoing training after medical training. Maybe in residency. And that it seems like that's when you started to adopt and begin teaching, but maybe even into your career. Do you think that's important, and what should we be doing?

Dr. O'Brien: Yeah, I think you teach the theories, but the way you learn is the examples. So as in the first year, I give them that basic introductory lecture, but then I show them example ECGs where the patient has situs inversus, an an arm lead reversal where they switch the arm leads. And I show them, how do you distinguish between those? Because an inverted P wave in lead one, it's negative. It's either arm lead reversal or it's situs inversus. And then you gotta look at the R wave progression to figure out between the two. So I'm trying to make teaching points based on examples. And then I show them WPW 'cause we talk about intervals, lines, and segments during that introductory lecture. And I talk about bypass pathways, and I say a normal PR interval is supposed to be 120 to 200 milliseconds. Look at this ECG and what do you see? And the short PR and the slurred upstroke. And we talk about the why behind it so it gives them cognitive resonance. So as they learn it more, they can apply it. And in the second year, again, I show them example after example after example. So I show them, you know, different types of Afib, different types of AFlutter. I show them AV node reentrant tachycardia. I show them ventricular tachycardia. I show them torsades. And then in the third year, again, it's all example based. And it's practice, practice, practice. And then to answer your question about after training, it's just repetition. You really need to read ECGs. For the students, what we do on the third-year clerkship is we say one of the procedures you have to do on a clerkship is read 10 ECGs with your team. And then it has to be signed off by the residents. So I know that the residents are reading ECGs with the medical students, and that's giving them practice as well. And then when I round on Fridays, I round at the VA, I read ECGs with the team. So I think you really need

practice at doing it. And the one point that I always try to make with the residents is for dysrhythmia interpretation, the machine is wrong 40 to 50% of the time. And if you were wrong that often in clinical decision making, would you trust yourself? So it really puts the onus on them to learn how to read ECGs.

Dr. Kashou: I really love how you really, you start with the foundationals of why. You know, why do we actually see these features on the EKG? And I think that's so key and so fundamental because as you build that foundation, as you build on some of the, you know, you mentioned the intervals of WPW, adding the clinical correlate, it starts to make sense. And that's where, as you mentioned, in your career and even out of residence, that's where the practice becomes, you know, okay, I can recall why that occurs. I can recall why this is, you know, limb lead reversal and not, you know, situs inversus or dextrocardia and so forth. And so I really appreciate how you lay the foundation because that just makes everything click so that when you're actually going through all the practice in the future, it's a lot easier. Well, I just wanna, you know, add are there any other things that, you know, you'd like to share with our audience? I was really excited, you know, to have you on just because of, you know, your experience and just working with you, and how much I've learned from you in just a short amount of time.

Dr. O'Brien: I think that reading an ECG really shows knowledge, and it shows skills, and it shows attitude. I mean, if you break down a learner or a resident into what makes them good, it's knowledge, skills, and attitude. And the only way you learn how to read ECGs is you practice. And you've gotta have a good attitude about it, and you practice, practice, practice. And when you don't understand things, look it up. So I'd love to see them progress from the Thaler ECG book as a student to the Marriott book as a resident, to Chou or Chou, however you want to say it, as an attending so that you're teaching higher level things depending on your audience.

Dr. Kashou: Amazing. And, you know, a lot of people say, "How do I stand out?" Be able to interpret an ECG. And I think you heard it right from the boss here. So the ECG remains an essential aspect of patient care. Even with technological advances, the skill will continue to be fundamental to the practice of medicine. Educational approaches that merge traditional and digital learning approaches will be critical in meeting and maintaining competency standards for all medical professionals. Dr. O'Brien, thank you for sharing your insights into this important skill. Thank you for your continued dedication and efforts in improving ECG literacy amongst our colleagues and medical professionals. On behalf of our team, thank you for taking the time out of your day to join us. It's been a true pleasure.

Dr. O'Brien: Thanks a lot.

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