

The Importance of ECG Interpretation in Medical Practice

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." The electrocardiogram, commonly known as the ECG or EKG, is more than just lines on a graph. It's the story of our heart, narrated through electric impulses that we see on this graphical display. Today, we're going to step back from a lot of the work we've done, and we're gonna look at the importance of the ECG and how clinicians, how it's important for them to be able to not only know about this skill, but even do it competently in medical practice. Now, we're fortunate to have Dr. Adam May, who is a cardiac intensivist and assistant professor of medicine at Washington University School of Medicine in St. Louis joining us today and through this series. And this series is gonna really go over the foundational knowledge of why the ECG is important today, and then we'll continue to look at different aspects of this work. And so I wanna first thank Dr. May for joining us. So glad to have you back with us today.

Dr. May - Thank you, Anthony. Thank you for having me back.

Dr. Kashou - Well, you know, I've been really excited about planning this, working with you on this and really, instead of more of a formal, I wanted to have a discussion with you about this because, you know, we have so much of this and someone's like, why don't we just get that out there? And, you know, so start really from the beginning. Maybe you could share for those audience that maybe isn't familiar with the ECG and, you know, this sort of skill, why is it considered so essential for medical providers to be able to be competent and proficient in it?

Dr. May - Well, thank you Anthony. I think this discussion should be a lot of fun. Yeah, so great question. The ECG is extraordinarily important. It's very pervasive within medical practice and it's full of rich and powerful diagnostic information that can be given to providers to help their patients. First off, it's readily available. It's within every healthcare institution that you can imagine. It's a non-invasive tool that is relatively inexpensive and it is ubiquitous. Now, hundreds and hundreds of millions of ECGs are obtained every single year. Now, the information that we can get from this can tell us a lot about a patient's heart and including severe or serious problems with it. And ultimately, it can provide a great guidance for medical providers to treat patients. Now, there's a lot of things that can be learned from the ECG, Anthony, and you know this perhaps better than nearly everyone. A question I would like to ask you is how does accurate ECG interpretation impact the care of your patients, especially within medical emergencies?

Dr. Kashou - Yeah, so you've kind of switched it, you flipped the game. So now you're asking me questions. This is good. This is gonna be fun. You know, and just to highlight a lot of the, you know, the essential parts, I want to echo what you mentioned. So our audience here is it is that, you know, you mentioned the ubiquity. You know how non-invasive is a really pain-free

rapid test guides treatment. And the next question you were asking me is why does accurate interpretation matter? And this is something, you know, both of you and I are passionate about, and well, there's many reasons but one thing is that you've mentioned already that it guides treatment but what the ECG can do is provide us with a rapid diagnosis. And I think this is really important in critical scenarios. You know, if someone has a myocardial infarction or heart attack, you know, every second counts, you know, the ADA that they say is time is muscle aptly captures the essence of the urgency. You know, the heart muscle can sustain irreversible damage if it's not treated promptly. And so accurate interpretation and we know the ECG is able to do that, it's able to highlight some of these findings even early on before things get worse. And so one example would be maybe hyperacute T-waves showing that pattern. Now we see it not only as a rapid diagnostic tool, but also a decision making tool. You know, a lot of our guide guidance of, you know, when should we take someone to the cath lab, you know, should we pursue an early invasive approach, you know, relies somewhat on what the ECG shows. And, and so that is, you know, an important factor. And we can also use it to risk stratify our patients. Not everyone that comes in has the same risk profile and the ECG acts as you know, this C, it really is able to categorize those that are susceptible to more adverse or complicated events. And so there's certain ECG patterns that, you know, would put patients at higher risk, maybe require more implantable devices or a pacemaker to, as a therapeutic option. And so, you know, apart from rapid diagnosing it helps decision decision making risk stratification. And I, you know, as you mentioned earlier, it guides our monitoring with our patients and really reduces unnecessary treatments. And, you know, I don't know if there's anything else that you would add to that, but you know, those are the things that really come to mind. And, you know, the follow-up question I would ask you or you know, what are the common things that you see that you know we should be looking at for on an ECG?

Dr. May - Yeah, so again, you know, I mentioned that the ECG is full of rich and diagnostic information. That can mean a lot of different things and a lot of different, you know, electrical and also structural problems at the heart. By far in the way, one of the most common uses of the 12-lead ECG or any sort of monitoring device that uses ECG would be arrhythmias. Detection of irregular heart rhythms like atrial fibrillation, premature ventricular contractions, ventricular tachycardias, brady arrhythmias. This is a core use and, of what the ECG provides to medical providers. There's also, you know, not to be, you know, overdone by arrhythmias would be, it's used for detection of ischemia or myocardial infarction. Findings of ST segment deviation, T-wave inversions is other ischemic findings could really tell providers in an immediate almost immediately that a patient is having a severe myocardial infarction or some other form of cardiac ischemia. Now, other issues that it can detect would be electrolyte imbalances, you know, changes with, you know, peak T-waves I heard you mention, there could also be QT interval prolongation in the setting of electrolyte deficits like hypomagnesemia. There's also structural issues or that can be identified from the ECG, cardiac chamber enlargement, left ventricular hypertrophy, scar on the heart can also be detected. And again, conduction abnormalities, that's another aspect that is commonly looked at or commonly found on 12-lead ECG. And that would be bundle branch block patterns, atrial ventricular block patterns, first degree, second degree, and third degree, and other disruptions within the heart's electrical pathways. So a lot of different uses and findings that you can get on the 12-lead ECG, but Anthony, I'm interested in asking you a question. You know, there's a lot of things to learn on the the 12-lead ECG, and we discussed just a minority of them in a almost a surface level type of way. ECG interpretation is important,

we all know that and it's turned into a core component of medical education. So I'd like to ask you this, how has ECG interpretation evolved as a core component of medical education?

Dr. Kashou - Yeah, well, it is a really good question. And as you mentioned, we are kind of just putting these buckets of, you mentioned arrhythmias, ischemia, electrolyte disturbances, structural issues, conduction abnormalities. I mean, those are kind of the buckets we think of when we teach different, you know, medical professionals how to actually learn this skill. And if I have to be honest, I think we have to go back to the roots of the ECG and it, it's really back in the early 1900's and since its inception it's really transformed the landscape of cardiac diagnostics. You know, you have the Dutch physician, Willem Einthoven is credited for its invention, could scarcely have imagined a monumental role, Now we're using the ECG in today's world of modern medicine. It's swiftly become as we've mentioned, an indispensable tool, you know, beyond just cardiologists as ourselves, it's other professionals that use this every day. And so, you know, it's beyond, it's amazing that we still have this tool that we have with us, but like any other domain in medicine, the realm of ECG, we've really seen this like witnessed this technological leaps, you know, this renaissance I like to call it in this space where, you know, we've gone from the rudimentary, you know, string galvanometer and that was early 20th century if I think back to it. But now we're, we have these AI driven algorithms, we're seeing this profound evolution of ECG, still this simple tool, still non-invasive, still ubiquitous but really capturing a different aspect of it. And, you know, your question was how, why is this and how has it evolved as a core component of medical training? Well, we've known because of its importance that it's really important, you know, beyond just cardiologists and all of us, whatever, you're a paramedic, an EMT, or you're a nurse, resident. All of us that go through medical training are expected to have some baseline competency in this skill because it's so important as we've mentioned in impacting how we guide treatment. And, and so, you know, it's evolved. I would say that, you know, we'll soon see and we'll share in upcoming episodes that, you know, maybe we're not as far as maybe this old tool has really become an old thing that we're still not training as well as we should given it still has such importance. So, you know, without going on in sharing too long on this, you know, medical training's important. It has historical significance. We're seeing it still prominent in today's field and it's really because accurate interpretation impacts patient care. And what I wanna say to you and kind of end on this is we've talked about the importance of accurate interpretation. What happens and what are the potential consequences of inaccurate ECG interpretation?

Dr. May - Yeah, a great question Anthony. And a point I'd like to mention before I, you know, shout off a few things, is that it's this issue right here that ends up being why medical education has been important for 12-lead ECG interpretation skills training and a while will continue to be important for medical providers and all medical professions to get better at this. Now, one of the things that is feared with, you know, incorrect ECG interpretations which unfortunately does happen, is misdiagnosis and potentially important and serious ones, things like a myocardial infarction may go unrecognized, leading to delayed treatment and worse outcomes for the patient. Inappropriate ECG interpretation could also lead to inappropriate treatments. Misinterpreted results can easily lead to patients receiving the wrong or improper medication or interventions, those that they don't need and could really expose them to unnecessary risks beyond their native medical conditions. And ultimately, these two things in particular can lead to poor patient outcomes, but really it doesn't even end there. So beyond poor patient outcomes,

you know, improper interpretation of the ECG can lead to increased healthcare costs. So in incorrect interpretation can lead to more testing, longer hospital stays, more consultations that may not be needed in overall some, it is essentially some ate into increased medical expenditures for the patient. And not only that, they can have increased anxiety for a wrong, you know, wrong diagnoses or misdiagnoses over diagnoses can cause a lot of psychological and emotional distress for patients. And then the other thing that can definitely happen and it is unfortunate with medical-legal repercussions. ECG is a common, ECG interpretation errors are a common reason why, you know, bad things happen within medical practice and why a lot of people end up going through litigation. And it all kind of, you know, goes back to poor or incorrect ECG interpretation. So those would be the potential consequences of incorrect ECG interpretation.

Dr. Kashou - And, and so I heard misdiagnosis, inappropriate treatment, you mentioned increased healthcare costs which you could certainly see, you know, patients becoming anxious of, you know, especially with this mobile era and you know sending in things and new alerts, you know, there's that extra emotional distress. And then yes, these repercussions because some can have some legal consequences if certain things go missed. You know, any final words that you know you want to say before we end here?

Dr. May - So Anthony, this was a lot of fun. I think this is a good discussion, a good starter discussion. I think there's a lot to be said about the ECG and a lot that still needs to be said despite the things that we went over. And I can't wait for upcoming, you know, discussions with you about the all and powerful great ECG.

Dr. Kashou - That's a great way to end it, you know, and I do wanna say the things we've covered and this is gonna be a long series, so hopefully you're on for the ride for us, but you know why the ECG is essential for medical providers, right? Accurate interpretation impacts patient care, especially in medical emergencies. We saw that some of the diagnostic things that we look at from arrhythmias to conduction disturbances to ischemia, structural abnormalities and so forth. And we've seen how it's evolved over the years and the potential consequences of inaccurate interpretation. Now, there's a lot that we have planned for you in upcoming episodes, but as we wrap up today's episode, we've hoped you've gained a deeper appreciation for the art and science behind ECG interpretation. It's truly important. Those seemingly simple lines trace the silent tales of countless hearts, speaking volumes to those who understand their language. And so we have to do a better job of teaching our medical colleagues. Remember, every wave and segment tells a story. And with each episode, as we continue to progress through this series, our goal is to help you to read those tales more accurately. And we want you to stay tuned because we have a lot of fun things. Thank you, Dr. May, for joining us. We look forward to having you back with us next time. And in the meantime, let's keep the rhythm going.

Dr. May - Thank you, Anthony.

Dr. Kashou - Thank you for joining us today. We invite you to share your thoughts and suggestions about the podcast at cveducation.mayo.edu. Be sure to subscribe to a Mayo Clinic cardiovascular CMD podcast on your favorite platform, and tune in every other week to explore today's most pressing electrocardiography topics with your colleagues at Mayo Clinic.