

Episode 56: Every minute matters: The power of high-sensitivity troponin

Josh Casey: Hi, I'm Josh Casey. Welcome to *QuidelOrtho Science Bytes*, your trusted source for diagnostic insights and innovations. Today, we're talking about the role of high-sensitivity troponin testing in advancing early cardiac diagnosis. In acute care settings, every minute matters, and timely, accurate diagnostics play an important part in helping clinicians make faster and more confident decisions. Joining us today for more insight into this topic is Dr. Lindy Carlstrom, Global Medical Affairs Manager for QuidelOrtho. Lindy's clinical experience spans from emergency medicine to critical care and primary care. Currently, she's responsible for providing medical support for the QuidelOrtho acute care menu throughout the product life cycle. Lindy is passionate about clinical education, testing guideline updates and assay utilization to drive improved patient-centered outcomes. Welcome, Lindy. It's great to have you back. Thanks for being here today.

Lindy Carlstrom: Thank you, Josh, for the invitation. It's great to be back. I'm excited to talk about this topic.

Josh Casey: Great, well, let's start with a bit of background. Why has high-sensitivity troponin become such an essential tool in cardiac diagnostics?

Lindy Carlstrom: Yes, high-sensitivity troponin testing allows clinicians to detect very low levels of cardiac troponin with a high degree of precision. This is important. These small, low levels and a high precision are important because even small increases or decreases in troponin can mean that damage to the heart is occurring and changing, and that a situation needs urgent medical intervention. By identifying such changes in troponin earlier, clinicians can therefore make faster, more informed treatment decisions when evaluating patients with suspected acute coronary syndrome.

Josh Casey: I see. And how does high-sensitivity troponin improve early diagnosis of heart attacks?

Lindy Carlstrom: Right, so before high-sensitivity troponin, we had what are called contemporary troponin assays. Those tests did not measure troponin as low as high-sensitivity assays, and they did not have as much precision. And we'll talk about precision more in detail later. But basically, these tests that are contemporary troponin tests require more time before an elevation in troponin becomes detectable. High-sensitivity assays in contrast, detect lower levels and even normal levels in healthy people, which means if they can measure the normal level, they can catch that early elevation to an abnormal level earlier, right after a myocardial injury starts. And then if you can find the injury earlier, then that enables clinicians to either diagnose or rule in that something is going on or rule out that myocardial infarction is not happening, and then that can increase time to get patients through the emergency department either back home because nothing acute is going on or move them into the next setting of care where they can get definitive treatment and get better outcomes.

Josh Casey: Let's go a little deeper on that. What role does high-sensitivity troponin play in ruling out cardiac events?

Lindy Carlstrom: Yes, because high-sensitivity troponin assays measure troponin so low, it gives it really powerful negative predictive value. Meaning if you've been having symptoms for three hours or more, high-sensitivity troponin would be noticing that there's something going on with your heart. High-sensitivity troponin would be noticing something's going on with your heart and would pick that up earlier than a non-high-sensitivity assay or a contemporary assay. When a troponin level is either low or

not changing over time, then clinicians can be confident that a heart attack is not happening and the patient is safe to go home. And then this will help avoid unnecessary admissions, less testing for patients, and it lets the low-risk patients get reassurance and be safely discharged without spending more time in the hospital than they need to.

Josh Casey: Got it. So you mentioned precision earlier. Why is this such an important aspect in a troponin assay?

Lindy Carlstrom: Yes, so different tests have different precision requirements, and it's all depending on how the clinicians use the test. But what precision is, is it's how reproducible the result is, how much you can get the same answer when you repeat the test on the same sample. If the same sample is measured multiple times and the test has great precision, the results are going to be very close to each other. I love providing numbers and specific examples to help explain this. So an example of good precision is 10%. This means getting results like 10.0, 9.9 and 10.1. All those results are within plus or minus 10% of each other. In contrast, an example of bad precision, at least for how we use troponin, is measurements like 10, 8 and 12. In that case, the results are within plus or minus 20% of each other. And the whole reason that high-sensitivity troponin and good precision near the cutoff, or the 99th percentile, is critical is because of how we define myocardial infarction. So there's been a series of four publications titled Universal Definition of Myocardial Infarction. And they require that at least two troponin values be at least 20% apart in order for acute myocardial injury to be diagnosed. And once you've diagnosed acute myocardial injury, that's the first requirement to eventually get to the diagnosis of myocardial infarction, or heart attack. So, because you need those two tests and you need to know that the change between those two tests is significant, if you have a test with bad precision where the test is giving you different numbers, then you can't tell the difference if the difference is due to the test having bad precision or due to a difference actually happening in the patient. So, high or bad precision is not reliable for telling if that small difference between samples is coming from the patient. It could just be the test isn't going to give you the same answer each time. And then when we're making clinical decisions about whether or not we think a heart attack is happening, paired samples, serial samples over a short time period, like one, two, three hours are important. And then the other thing we look for is if the values are getting close to the upper reference limit, which for troponin is the 99th percentile. There are even some hospitals that do really rapid protocols using lower values below the 99th percentile. And ultimately high analytical precision at these lower cutoffs, where we know the patient is going from healthy to unhealthy heart, ensures that small yet clinically meaningful changes between serial samples are real and not just because the assay has a lot of variability. One final thing, the thing I like to say about precision is you can kind of think of it like a golf score, a lower number is a good thing. It means you're better at precision or better at golf. And this reliable low-end precision is essential for accurate diagnosis and risk stratification using that serial testing.

Josh Casey: Regarding the impact of high-sensitivity troponin in the emergency department, how has this test changed workflows for clinicians in the ED?

Lindy Carlstrom: Right, so before we had high-sensitivity troponin, like in the era in which I practiced emergency medicine, we had contemporary troponin assays. So we were measuring troponin in some patients three hours apart or six hours apart, up to eight hours apart, because we had to wait that long for the change between samples to be greater than the change we would just expect from the test, having poor precision. So now that we have high-sensitivity troponin, you can take that time interval

between samples and make it much shorter. So high-sensitivity troponin lets us use accelerated diagnostic pathways or clinical decision pathways, and that allows shorter patient stays because we can get to an answer if they're changing or not faster. So to say it more concisely, we can shorten the time between serial samples from doing them at 0, 3 and 6 hours to just 0 and 1 hour or 0 and 2 hours. This can ultimately reduce the length of stay in emergency departments for these patients with possible acute coronary syndrome, which will improve patient flow and help prioritize care for those who need an urgent intervention while safely sending other people home after making sure they're not having a cardiac event.

Josh Casey: So why is an earlier cardiac diagnosis especially important? What effect does it have on patient outcomes?

Lindy Carlstrom: Yeah, so a few things here. One thing is that research shows that the longer patients spend in the emergency department, the more dangerous it is. So the busier the emergency department is, the harder it is for them to get through patients and decide who needs to go upstairs. So if there's less people in the ED, they can just make those decisions faster. And the way that troponin helps with that is you can get those low-risk patients ruled out for heart attack faster and get them out. Then you have that bed open either for another patient to fill it or so that the care providers working in the emergency department can focus on the patients that still need a decision made. And then earlier diagnosis, if you rule in a heart attack, you can get to urgent intervention faster, or you can, some patients who have heart damage don't need to go to the cath lab, but they are sick from other causes that are also impacting their heart. And you get those patients following those non-cath, non-cardiac pathways sooner to get to get to definitive care. And then studies have also shown that when you have timely diagnosis and timely intervention, that reduces mortality and therefore improves long-term outcomes for patients with acute coronary syndromes.

Josh Casey: Great, thank you for that. Clearly, a case where faster really is better. Can you please talk a bit about guideline alignment when implementing high-sensitivity troponin testing?

Lindy Carlstrom: Yes, so the clinical guidelines from all over the world increasingly recommend or state that high-sensitivity troponin in testing is preferred because it has higher diagnostic accuracy and therefore better clinical utility. When hospitals align with evidence-based guidelines, this helps ensure that the care patients receive when they change facilities is consistent. And this also reinforces patient and clinician confidence in their test results and the decisions made based on those test results.

Josh Casey: Turning now to the important topic of equitable care, how does high-sensitivity troponin testing contribute to equal care across diverse patient populations?

Lindy Carlstrom: Yeah, so high-sensitivity troponin testing improves diagnostic accuracy. It gives us a really objective measure across diverse patient populations, including both women and older adults who often will present with what we used to call atypical symptoms or have lower troponin levels because they have smaller bodies or smaller hearts. And then the other advantage of high-sensitivity troponin assays versus contemporary assays is they have sex-specific cutoffs or 99th percentile. So when you use a different cutoff for a male versus a female, that helps get to more equitable decision-making. You can find those smaller heart attacks and stop them while they're small before they get to being bigger.

Josh Casey: Considering how many factors go into a cardiac diagnosis, what challenges should clinicians be aware of when interpreting high-sensitivity troponin results?

Lindy Carlstrom: Yeah, the challenge is that there's sensitivity, which is the ability to find a problem, find that something is wrong. And then there's also specificity that the thing you've found is wrong is actually a specific diagnosis that you know, it's a heart attack and not a different kind of damage to the heart, like heart failure or myocarditis. So the trouble with high sensitivity is when you push sensitivity down, you are pushing specificity up. When you get goods, there's sort of a, relationship between sensitivity and specificity is like a seesaw on the playground. When you push the sensitivity side down, the specificity side goes up, which that means that clinicians who are new to high-sensitivity troponin have to learn that some troponin elevations are not due to an acute heart attack, they're due to something else. So the most important way to figure out, think to tease that apart, is to use serial measurements. That can help you determine if this is just a chronic troponin elevation. The patient has a sick heart, but there's nothing changing today. This is just their baseline where they always are. And in the universal definition, that's less than 20% apart. So if you get two samples and they're elevated, but they are within 20% of each other, then the heart's not acutely changing. The heart's not healthy, but it's not the thing that drove them in today. Whereas acute myocardial injury, those serial troponin samples will be rising or falling by 20% or more. And that means that the damage to the heart is actively evolving and likely to benefit from treatment. The other thing about acute myocardial injury is, if the values are falling, that doesn't mean the patient is doing better than a patient with rising values. What that actually suggests is the acute event started longer before the patient presented for care, and that they might have accrued more damage than someone who shows up early. And that can make it harder to get them a better outcome. And then, finally, clinical context is essential. Knowing what the patient was doing when their symptoms started or how their symptoms have responded to things that they've tried, like sitting down and resting, or the medications given to them on the way into the hospital by the ambulance. The universal definition of myocardial infarction: you not only have to have acute myocardial injury, but you need to have clinical evidence of myocardial ischemia or lack of oxygen to the heart in order to call it myocardial infarction. So just because their troponin is elevated, it doesn't mean it's a heart attack. The patient needs to also have other things that suggest it's a heart attack that could be symptoms, changes on their electrocardiogram, their ECG, or imaging findings that prove that it's ischemia. And then these other conditions, other than heart attack, that still damage the heart and elevate troponin are, there's a long list, but the most common ones are heart failure, kidney or renal disease, or even sepsis. These will elevate troponin. And so it's really important to combine all the laboratory data and all the clinical assessment because you have to know everything that's going on with the patient. You might have to start multiple treatments if they've got multiple things going on. So you can rule out MI that just takes, you know, one of five things off your list that you still need to take care of.

Josh Casey: You've explained how important time is in diagnosing and managing patients with suspect cardiac conditions. How does serial high-sensitivity troponin testing enhance clinical confidence?

Lindy Carlstrom: Right, so serial testing allows clinicians to detect changes in troponin levels over time. So they're not just relying on that single measurement. And the universal definition of myocardial infarction states that troponin values must demonstrate a rise and/or fall, or you can't call it an infarction. This means good assay precision is the test can detect a rising or falling pattern. And then that strengthens diagnostic accuracy and helps you prove and be more confident that when the test is highly precise, then you know that that change is coming from the patient, and you can move forward and get

the patient. You're confident that the treatment you're going to give the patient is going to improve them. And then because high-sensitivity troponin assays have good precision of at least 10% and often great precision of 5% or less at their 99th percentile, high-sensitivity assays can reliably determine that a difference between two serial samples is because the patient is actively changing right in front of you. Like I said before, before we had high-sensitivity assays, before 2017 in the U.S., we had to wait much longer for the test to be able to show us that the patient was changing. That's kind of scary. You have to wait for the patient's heart to get sicker, sick enough for the test to detect the change so that you know what's actually going on with the patient. It's a much safer era that we're in now with high-sensitivity troponin.

Josh Casey: We've uncovered so much insight into the clinical utility of high-sensitivity troponin and how it's used today. Looking ahead, what role will high-sensitivity troponin play in the future of cardiac care?

Lindy Carlstrom: Yes. So high-sensitivity troponin testing will continue to be foundational in acute cardiac diagnostics because it enables faster decision-making that improves patient flow and makes risk assessment more personalized. There are new disease areas that researchers are trying to apply high-sensitivity troponin to. There's a lot still to be figured out, but these include cardio-oncology, non-cardiac surgery and perioperative MI or even perioperative troponin elevation. And even there's a hope that someday we could use troponin for screening of the general population for cardiovascular risk prediction. But what's holding these spaces back right now is they all need more evidence for the right treatment that improves patient outcomes before troponin and details about troponin can be broadly recommended. The hard part is that generally a physician's responsibility is not only identifying that a patient either has disease or is at risk of having disease, but then we can provide the patient with recommendations to reduce that risk. So we have to be able to know what to do about it as the next step. So as healthcare systems focus increasingly on early intervention and preventive care, high-sensitivity troponin will remain a key tool in delivering timely, high-quality cardiovascular care.

Josh Casey: That's great, thank you. And that's all the time we have for today. It's been a great conversation, really helpful in understanding how high-sensitivity troponin testing is supporting clinicians in detecting cardiac injury earlier, making faster and more confident decisions in acute settings, and improving how patients are triaged and cared for. From supporting rapid rule-out pathways to enabling more equitable and informed cardiac diagnosis, it's clear that early testing plays a critical role in improving patient outcomes. Thank you for sharing your insights with us today, Lindy.

Lindy Carlstrom: Thank you for having me back, Josh. It's always a pleasure to help teach something about medicine and diagnostics.

Josh Casey: That's great. Thank you. We appreciate it. And thank you all for tuning in. Please be sure to check the links in the podcast description for additional resources on high-sensitivity troponin testing and its role in early cardiac diagnosis. If you're interested in going deeper, you can revisit Science Bytes episode number 44, exploring how timely diagnostics support faster decision-making and better patient outcomes across acute care settings. Early insight can make all the difference when it comes to heart health. If you haven't already, please subscribe to *QuidelOrtho Science Bytes*, our monthly podcast brought to you by QuidelOrtho Corporation, where we're advancing the power of diagnostics for a healthier future for all. Until next time, take care, everyone.