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Discussion to: Advanced Artificial Intelligence Guided Hemodynamic Management within Cardiac Enhanced Recovery After Surgery Pathways: A Multi-Institution Review

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Invited Discussant: Dr. Arman Kilic, MD

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Disclosures:

Dr. V. Seenu Reddy is a paid consultant for Edwards Lifesciences

Dr. Arman Kilic, Consultant, Speaker; Abiomed: Consultant, Speaker; Abbott: Consultant; 3ive: Consultant, Speaker; LivaNova

Dr. Arman Kilic (Charleston, South Carolina):

Thank you for the invitation to discuss this paper. AI has tremendous potential to transform—excuse me, how cardiovascular healthcare is delivered, and I congratulate the authors on this elegant multicenter analysis. I have three questions. One, we are now living in an era of reduced ICU and bed capacity, high nursing and staff turnover, high stress, and burnout. One factor that needs to be strongly considered with decision support systems, including those based on AI, is the burden of false positives or background noise. Theoretically, if the
support system is providing many signals or alerts and many are not clinically relevant or acted upon, this may have an opposite effect of what's intended and lead to increased burden to providers with minimal benefit. Do the authors have a sense of what clinicians in the field thought about this decision support system, and to what degree were false signals provided that were ultimately ignored?

Dr. V. Seenu Reddy (Nashville, TN):

I can answer.

Dr. Kilic:

Maybe give you a chance to respond, and then I'll go with the other questions.

Dr. Reddy:

Well, actually, I'm going to invite my co-author to talk about his institution. I'll give you a quick answer on ours.

Unidentified Speaker 1:

So, I think there's a very quick answer actually to this, which is the nurses love it. They enjoy the autonomy. They recognize the speed with which they're moving with the patient, and when you walk in the room, they can give you their feedback immediately on what their volume resuscitation requirements were, how volume responsive they are, where they are in their inotropes, etc., and they have a better overall grasp than we used to have when we were using Swan-Ganz catheters, which we never use anymore.

Dr. Reddy:

And my answer is your question goes to the nexus of all of this, which is what I wished I had been able to get our group to measure, which is nursing burden. I don't know a metric for that. I'd love for anyone in the audience to tell me, how do I do that? Because that's the other powerful piece of this that I really wasn't able to demonstrate is it actually reduced nursing burden and actually reduced the number of phone calls to intensivists because that predictive index helps them treat the patient before it happens. You're not kind of in that alert mode, or crisis mode, rather.

Unidentified Speaker 1:
I think it's important too with that nursing turnover with younger, inexperienced nurses and travelers that we have to get by with now. I think it simplifies it for them.

Dr. Kilic:

Yeah. I think a good piece of information may be survey-based where you engage with some of the stakeholders at the front line to see how—

Unidentified Speaker 2:

There's actually a good metric for that. It's a surrogate, but nursing time spent at the bedside versus charting is a decent metric for—

Dr. Kilic:

The other question relates to study design, which was a pre- versus post-implementation comparison with the groups separated by a few years. So, were there any changes in the ERAS pathways or QI efforts at each individual center over that study period? And secondarily, was there any insight into variability between the three centers in their pathways or QI initiatives that may confound these results and explain some of the differences you saw between centers?

Dr. Reddy:

Yeah. So, all of the centers already had ERAS pathways, so it wasn't-- but we really were trying to isolate the effect of this implementation of this technology, and that's part of why those centers were chosen, so not really in terms of doing other substantial ERAS things differently. The best way I guess to explain the inter-center variability is just that some of the rigidity to which they may have adhered to-- one of the centers already had a really good early extubation protocol.

Dr. Kilic:

Okay. And last question, it's great to have new innovations and technologies to use in real-world practice, but education of providers and staff on how to use the technologies and logistically making implementation of the technology as seamless and painless as possible is essential. How did the authors educate their respective ICUs with regards to the support system, and were there any logistical issues related to real-time use?
The logistical issues go really to Dr. Gerdisch's point, which is the nursing turnover. So, you really again go to a very critical point; with any introduction of pathways, whether it's ERAS or technology such as this, what is needed is partnership, so it was a pretty tight partnership. We had really good support from our institutions. There are a lot of nurse educators that are stationed at each of our ICUs but then also tremendous industry partnership. I have to say that it really would not have been possible without the industry partner, which was Edwards, being in the hospitals and providing personnel both to train, troubleshoot, QI all of this technology.

Dr. Kilic:

Thank you.

Unidentified Speaker 1:

Dr. Whitman.

Unidentified Speaker 3:

I just have got to point out that everybody was listening to Arman Kilic just then, and several years ago, he wrote a seminal paper that showed that the cost of cardiac surgery is extremely hospital-specific and not patient-specific. What I have spent so many years trying to accomplish in an ICU is that hypotension doesn't equal hypotension doesn't equal hypotension. Some hypotension equals volume. Some hypotension equals pressors. And when I watch this - and again, I haven't read the paper - you have got to explain to me how this program that says, "Bill, RN, you're about to experience hypotension. Treat it," and you're telling me that this program can figure out whether the hypotension's vasoplegia versus volume? Explain that to me and us.

Unidentified Speaker 1:

I can, or you may.

Dr. Reddy:

Yeah. So, I think the point is, just as you say, all of these technologies are just that. It's a technology. It doesn't figure out for you necessarily which type of hypotension it is. That's what the clinician is still there for. But it does give you an algorithmic pathway in which to treat it, which I'll actually go into. I think
both Dr. Chatterjee and I will address that in our hemodynamic 101 and advanced hemodynamic talks, so more to follow on just that point.

Unidentified Speaker 4:

As a follow-up question, how much of this do you think was Hawthorne effect, getting people more interested and more involved in these issues made them pay attention?

Dr. Reddy:

Well, we didn't really tell them that it was a study, so the Hawthorne effect kind of is based on the fact that people know that they're in a study and that they're being watched. This was just like, "Hey, we have this new tool. Would you use it?" and implemented the new tool.

Unidentified Speaker 4:

And how hard is it to interpret some of the things beyond HPI, maybe [inaudible], DPDT?

Dr. Reddy:

That's the education component. That goes to his point—

Unidentified Speaker 4:

Do you think we need more clinical decision support where it kind of gives a little more algorithmic input as Dr. Whitman was talking about maybe that would help the bedside provider suggest hypovolemia, suggest inotropes, suggest diuresis?

Unidentified Speaker 1:

Yeah, and I think they're going to cover this later. I really do because when I walk in the room, the nurses understand it better than I do now, and I thought I had a pretty good grasp of it. So, by living it, they start to kind of know what the signals are, and it doesn't take that long. I've noticed that within two weeks, any one of our nurses managing the devices becomes an expert, so I think we should wait so they can kind of about [inaudible]—
Dr. Reddy:

Yeah, good point.

Unidentified Speaker 1:

--and the volume resuscitation etc. It basically runs off of DPDT and stroke volume and looks at the [crosstalk].

Dr. Reddy:

Dr. Salinger.

Unidentified Speaker 2:

I had a couple of questions, actually. When you guys start your GDT, do you start it after an initial liter in the ICU or just start it the second they get to the ICU, and does anyone do it--has anyone done it in the OR?

Dr. Reddy:

So yeah, the answer is yes to everything. We have it on in the operating room. The technology predates cardiac surgery, of course, and it was really designed for intraoperative management of volume status—

Unidentified Speaker 1:

In big abdominal cases.

Dr. Reddy:

--abdominal cases, right? Exactly. And then we just decided to extend it into cardiac surgery. And on pump, you don’t need it obviously, but we have it set up at the beginning, we have it fired up at the end, and then once they get to the ICU, the nurses are plugged in and ready to run.

Unidentified Speaker 1:

Switching gears, just thinking about Dr. Gerdisch rib to sternal fixation lecture, how confident are you that decreased opioid use, decreased [inaudible] utilization, etc., has anything to do with your use of rib-to-sternal fixation?
Dr. Reddy:

Yeah. So, I think that first of all, I'm pretty confident of it, and I kind of don't care. You heard this from me before. These patients are just-- they're so much better. And you know what? I used to hate it when people would say, "My patients look better now." Well, my patients look better now, and they're happier. And we all know that once people are taking those drugs, delirium, gut problems, all the issues-- okay, then you got delirium and a gut problem, and then they vomit on their incision, and then they get a wound problem, and then they're in the ICU, but you do enough cases that the patient just kind of disappears into the numbers, and you can't really remember that patient anyway a year later, but their life is ruined. So, I'm quite certain that it has redirected the experience of the operation. It's redirected the experience for the patients and the nurses really love it. I mean, it's a morale boost for the entire institution. The heart surgery patients are all running around, and 86-year-old women are going home.