Innovative Post-Transcatheter Aortic Valve Replacement Monitoring Program to Detect Arrhythmias and Heart Block

Interview by Jodie Elrod

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– Karen Ream, PA-C

In this feature interview, we learn about the post-transcatheter aortic valve replacement (TAVR) monitoring program at UCHealth University of Colorado Hospital in Aurora, Colorado. *EP Lab Digest* talks with Karen Ream, PA-C, Wendy Tzou, MD, and John Messenger, MD, about the program's implementation, benefits of post-TAVR monitoring, and use of Philips BioTel Heart's Mobile Cardiac Outpatient Telemetry (MCOT®) to monitor post-TAVR patients to detect arrhythmias and heart block.

Karen Ream, PA-C, MBA, Lead Cardiology APP, Senior Clinical Director of Inpatient Services

Why was the TAVR program started at UCHealth?

We initially started monitoring patients we felt were at a high risk for developing heart block post TAVR. We then had a patient that went home post TAVR, had a new left bundle branch block at their one-week follow-up, and died shortly after. It was very unexpected, and that was the moment we decided we needed to do something. So we decided we were going to start sending all our patients home on MCOT, because we didn't really know who those high-risk people were at the time. We had thought we could pick and choose who could safely go home, but after a case like that, we decided we needed to create a risk model to better identify which patients were at a higher risk for developing late heart block.

Who were the individuals responsible for or considered to be the driving force in implementing this monitoring protocol?

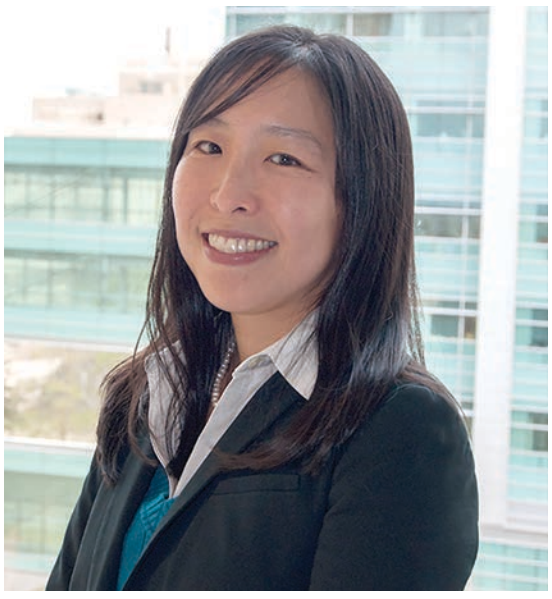
It was myself, along with one of our electrophysiologists (Dr. Wendy Tzou) and two of our interventional cardiologists (Dr. John Messenger and Dr. John Carroll) at UCHealth. They agreed that we should do this and make it happen. We then started a discussion with Philips BioTel Heart.

What were some of the challenges faced and adjustments that needed to be made?

Since the telemetry monitor is an ambulatory device and we're placing it on a patient at discharge, there were challenges in trying to work through the logistics of that, including how to bill for the hookup because it's not meant to be an inpatient device. Therefore, it was important to get support and buy-in on cost and doing what is right for our patients. In addition, making sure my team of advanced practice providers (APPs), who do the vast majority of these discharges, were up to speed on getting the monitor set up for the patients was another challenge. We also had to determine our system for who receives the calls and who is responsible for reading and evaluating all the data.

What tips do you have for others on how to develop a post-TAVR monitoring program?

Of all the people that I've talked to about this, what is clear is how well our interdisciplinary team, including our interventionalists, electrophysiologists, and surgeons, all work together and agree that this is necessary. So, I think the biggest piece of advice I can give is ensuring buy-in from those key groups in building a program. Since it's a TAVR procedure, the patient is first under the care of the interventional and surgical teams; however, if the patient goes into heart block, we need an electrophysiologist to determine whether a pacemaker is needed. I've heard that in some other organizations, having this type of collaboration is not that easy. I think one of the things we did really well was to discuss the process, the patients, and why we're monitoring. From the beginning, you have to get everybody on board to decide who gets the calls, what to do with them, and how to escalate. There are times when the process is seamless. For example, the patient goes into heart block in the early morning when they haven't yet eaten breakfast; we call them to tell them not to eat and come straight to the hospital, and they receive a pacemaker later that day and go home. However, patients usually need an overnight stay because they've eaten or it's late in the day. The ideal situation is to get patients taken care of and move on, and a clear process needs to be in place to do that or it doesn't work. We are always putting our patients first.



Interview with Wendy Tzou, MD, FACC, FHRS, Director of Cardiac Electrophysiology

From an EP perspective, tell us about your goals for the post-TAVR monitoring program at UCHealth.

This endeavor started when we recognized that there were patients that were still at risk, even though they didn't seem to have problems with heart block in the immediate post-TAVR period. Our goal was to optimize our overall management for these patients, capture those high-risk patients who did not manifest high-risk features for high-grade atrioventricular (AV) block prior to discharge, and then provide expedient care when needed. With increasing experience with TAVR procedures and implantation in lower risk patients, median discharge times post-TAVR have been about 2 days in the Society of Thoracic Surgeons (STS) National Database registry. Therefore, this program was also started in an attempt to provide a safety net for those patients that we

Figure 1. Photo of a patient wearing the Philips BioTel Heart MCOT Patch*.

**MCOT offers multiple wear options including Patch, FLEX™, and Lead Wire Adapter to provide a comfortable patient experience and high compliance.*

felt safe discharging earlier because of the indication that this was feasible, but recognizing that high heart block and high-grade AV block does still happen in a high incidence in those patients. So this was a way to help bridge that transition to more expedient care for patients on the inpatient side.

What measurements and assessments did you look at and put into place?

This initiative was driven by a couple of patient anecdotes in which delayed heart block, including one case of sudden death, occurred. This and similar, isolated events led us to monitor all of these patients for up to a month after discharge. In addition to real-time rhythm monitoring, we evaluated other data too, including baseline clinical variables, ECG variables at baseline, immediately post-TAVR, and pre-discharge. These were a part of the exploratory analyses, and other aspects of evaluation have subsequently arisen, including procedural details (type of TAVR, depth of implantation, etc.).

What led to your publication[1] in the *Journal of the American College of Cardiology* (*JACC*)?

It was our systematic analysis of all of these variables together among patients who did not have a pre-existing pacing device and did not seem to require a pacing device immediately after the TAVR was implanted that culminated in this publication. We identified a wide range of time to presentation with high-grade AV block (a median of 6 and up to 24 days in our cohort) and risk factors for developing high-grade heart block, including pre-existing right bundle branch block and hypertension.

How has this monitoring impacted patient outcomes for your TAVR patients?

I think the story is still yet to be completely told. We have definitely captured people that were high risk for developing complete heart block that now have pacemakers, so I hope that that actually translates into improved outcomes. There is still a signal for mortality post-TAVR that may be potentially tied to undetected post-TAVR heart block that might occur in the outpatient setting. My hope is that we've diminished that overall risk by more aggressively looking for this phenomenon of delayed AV block and identifying those patients before something terrible happens. I think that longer term data about how much pacing those patients subsequently require, and even a comparative analysis or trial conducted in a prospective way, is worth pursuing. This could include looking back to our historical experience in terms of outcomes such as mortality or survival following TAVR pre and post.

How has this monitoring also helped your overall TAVR program? Has this been expanded to any other areas (such as stroke) or other facilities within your health system?

Without question, it has overall improved the quality of care that we provide for our TAVR patients. There has been such traction with it that other programs at other centers have taken it on. With respect to other disciplines within our center not necessarily related to this post-TAVR project, we already had a good relationship with our neurology group with respect to monitoring for subclinical atrial fibrillation for patients who present with cryptogenic stroke. That was driven by the CRYSTAL AF data and less so by the post-TAVR data, but certainly, we always recommend more prolonged monitoring with a non-invasive monitor before putting in an implantable monitor. If you capture important events with non-invasive monitoring, then an implantable device is not necessary.

Interview with John Messenger, MD, Interventional Cardiologist

From an interventional perspective, tell us about your goals for the post-TAVR monitoring program at UCHealth.

We were interested in monitoring for heart rhythm disturbances after TAVR because we've had some experience in other realms. Our goal is to make sure that we capture any patient that has the potential late need for pacing in the high-risk period that appears to be in the first few weeks after TAVR.

What measurements and assessments did you look at and put into place?

We've been doing long-term monitoring. We have looked at inpatients who don't have either a pacemaker or pacemaker-defibrillator. We've been monitoring folks for 30 days for evidence of either high-risk features such as AV block or for atrial fibrillation and atrial flutter rhythms in patients that did not otherwise have indications for oral anticoagulation. We've been doing real-time monitoring for 30 days in every patient who undergoes a transcatheter heart valve. We have excluded patients with pacemakers. Also, patients who have valve-in-valve TAVR don't seem to be at a high risk, probably

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"We have a relatively conservative approach towards pacemaker placement, particularly preoperatively. We don't routinely place pacemakers, for instance, in patients with right bundle branch block that are undergoing TAVR." – *Dr. John Messenger*

because the surgical ring from the previous valve seems to protect from heart block. However, of the great bulk of patients we've been monitoring, we've been doing that for many years in our program.

Tell us about what led to your publication[1] in *JACC*.

We had previously described this entity of late complete heart block in our alcohol septal ablation program with our electrophysiologists. We had been doing alcohol septal ablation for symptomatic hypertrophic obstructive cardiomyopathy. What we noticed was despite patients having no periprocedural pacing needs and no heart block when we sent people out, particularly if we were restarting them on beta blockers or calcium channel blockers, that we had several patients come back within the first 30 days with late complete heart block. When we published that experience, we then noticed that we had the same phenomenon happening in our aortic stenosis patients who we were treating with TAVR. So we subsequently studied a larger group of patients and later published in *JACC*.

How has this monitoring impacted patient outcomes for your TAVR patients?

We have found patients that have previously not been identified to have atrial fibrillation and atrial flutter. About 5-10% of patients have evidence of heart rhythm disturbances that would benefit from being on oral anticoagulation, hopefully reducing the risk of stroke in that patient population. We monitored those patients and prevented them from having untoward events with early referral to the hospital and early pacemaker placement.

How has this monitoring also helped your overall TAVR program? Has this been expanded to any other areas or other facilities within your health system?

Yes, other facilities have started to do longer term monitoring. We're trying to see if we can do a multicenter clinical study looking at the role of long-term monitoring after this. For us, we have a relatively conservative approach towards pacemaker placement, particularly preoperatively. We don't routinely place pacemakers, for instance, in patients with right bundle branch block that are undergoing TAVR, which many programs do. So we think that it has decreased our rate of permanent pacemaker placement while still protecting our patients and making it safe for them to be monitored post procedure. ■

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Reference

1. Ream K, Sandhu A, Valle J, et al. Ambulatory rhythm monitoring to detect late high-grade atrioventricular block following transcatheter aortic valve replacement. *J Am Coll Cardiol*. 2019;73(20):2538-2547.