

Role of 3D Imaging in Complex Structural Heart Procedures (Screening/Suitability and Guidance)

Announcer: Welcome to the Mayo Clinic cardiovascular continuing medical education podcast. Join us each week to discuss the most pressing topics in cardiology and gain valuable insights that can be directly applied to your practice.

Dr. Klarich: Hi, this is Kyle Klarich coming from the department of cardiology in Rochester, Minnesota, in our series "Interviews With The Experts". And today I am very honored to be with Dr. Jeremy Thaden, assistant professor of medicine in the department of cardiology. Jeremy is an expert imager and spends a lot of his time in the interventional echo world helping to guide the procedures that we're doing more and more commonly. And he has been asked to talk about the role of 3D imaging in complex structural heart disease procedures, both in the screening and in suitability and guidance of the procedures. So Jeremy welcome.

Dr. Thaden: Thank you, Dr. Klarich. I appreciate it. Yeah.

Dr. Klarich: Good to have you here.

Dr. Thaden: Thanks.

Dr. Klarich: So 3D is something that we've been aspiring to for many years, probably my whole career but it's really come into fruition I'd say in the last decade, especially the last three to five years, really especially with inter operative and interventional procedures that we're doing on a really routine basis that help to guide the procedures. But could you talk broadly what you think 3D adds to the structural information that we get from a regular transthoracic or transesophageal echo?

Dr. Thaden: Yeah, absolutely. And I think that's absolutely right. I mean, think in recent years I mean the technology has come a long way. So successive generations of probes have improved frame rate resolution. And so, whereas previously we were frequently had to do multi beat acquisitions which are a little more complicated and there's limitations, now frequently we can do a single beat acquisition and get excellent diagnostic information. But I think when I think about 3D and what it adds to the practice, I mean I think about it sort of broadly in a few categories. And I think one of the most obvious is visualization. So I think for tea, for example if you're doing an exam of the Mitra valve you can typically understand the basic Mitra pathology with two, a good 2D image, good 2D examination. So you can understand there's a P2 flail, maybe there's residual prolapse in other parts of the valve, but when you turn on the 3D, what it does is it gives you sort a better understanding typically of more complex pathology. So it'll tell you more precisely where the flail is. It will tell you whether there's clefts on either side and you'll get a much better understanding of where the valve is prolapsing, where it's not, which for structure procedures is pretty critical. I mean, these are the types of things that we rely on to understand if we're doing a edge to edge repair where we're gonna go with a clip and potential clip strategy. So I think it gives you a better understanding of really complex anatomy and pathology. And then it also gives you the ability to go into these so called MPRs, or multiplanar reformatting. And so what that gives you then is really an infinite number of imaging planes. So

you can reproduce any imaging plane with a single 3D volume to see what it is you wanna see and what that facilitates is really more accurate quantitation. So you have the visualization and then MPRs are good for procedural guidance, but they also facilitate quantitation. So we can get things like valve orifice areas, regurgitating orifice areas, annular areas. You can probably get better leaflet lengths which is important for edge to edge repair compared to 2D. So some of these measurements aren't even possible by 2D, but we can do them with a high degree of precision with 3D. So

Dr. Klarich: Great. Well, I think that's a really nice overview of the summary that the echocardiographers are providing guidance to especially our interventional cardiologists but as you know, here at Mayo we use it in the intraoperative arena too. And I know our surgeons have become more and more akin to seeing that 3D image before they open the chest

Dr. Thaden: That's right.

Dr. Klarich: And they wanna know that's exactly what's going on with the valve. So it provides a strategy. Who do you think should be doing the screening and the procedural guidance for structural heart disease procedures?

Dr. Thaden: Yeah, so I think this is a really good question. I mean, I think it's gonna vary from institution to institution and I think it's different based on screening versus the procedural guidance. So for screening, our practice is that for screening structural procedures these are done by experienced basically level three advanced training echocardiographers, who have experience in structural heart disease. But I think you have to understand that's not possible everywhere. Right? So I think it is important obviously that the physicians, or sonographers for that matter, who are involved in the Ts and the TTEs, screening these patients have a basic level of training. But then I think the keys for screening are that you have to really have an understanding of the procedure and you have to have an understanding of some of the anatomic limitations for each procedure so that you can acquire the appropriate images. But I think for screening the other thing that can be helpful is to have access to raw images. So again, kind of coming back to the 3D thing what what's nice about 3D is that echo's a modality where if a 2D image isn't acquired at the time of the study, unfortunately you have to go back and get it. Unlike CT or MRI where they can reformat. Well, 3D is fairly similar. So if you have access to a good 3D image then actually you can go back and reformat later. So that can be an advantage maybe at a facility where a structural echocardiographer can't do every single study, but maybe other echocardiographers have experience doing it, they're comfortable with the procedure. But then if you have access to the 3D you can always go back and make measurements later. I think procedural guidance is a little bit different and there is a consensus document out there on what kind of experience, what kind of training is needed to guide these procedures. So what I would say is there's definitely a learning curve. There's not a lot of data on what is the learning, how many studies do you need to really perform these procedures at a high level but there are sort of empiric recommendations that you should be involved in about 75 of these procedures and a variety of procedures before you're practicing independently. Of course the limitation is that the volumes may be variable at different institutions. So that has to be taken into account also. But I see, I would say generally for guidance of these procedures, you'd wanna be level three trained

and have some specific training in these procedural, in these procedures themselves, preferably 75 procedures with an experience in a variety of them.

Dr. Klarich: Great. I think what I heard you say, and I think this is really key for the audience to understand, is that 3D now is becoming a lot closer to what we get with CT with using ultrasound. And that if we understand that, we can gather the data and then slice it and dice it at a later date. And I think that's one of the big things that we've been able to do at Mayo that's really made our practice successful is that we've all of our echocardiographers that are in the lab will be able to attain a 3D volume set, and then whether or not you have time, or the patient's comfortable enough to do some of these complex measurements at the time of the actual procedure or whether you store them and come back later and then do some of the slicing and dicing, as you say, to get different data available. So I think that's a really key point is that with the advent of really good 3D, which we have now with higher frame rates, with better usability, the user interfaces have gotten simpler and with more experience with it we've become very close to what we can get with a CT scan.

Dr. Thaden: That's absolutely right. And even transthoracic particularly for the tricuspid valve has come a long way and these procedures may not always be on our radar the first time we image a patient, but if we have a good 3D volume, we can always go back and say how big was the annulist, is the valve gonna fit? Or how long are the leaflets do we think edge to edge might work? So I think it having that raw data to access later is really, really helpful.

Dr. Klarich: And then the other thing I think you said, and I would agree with that, is that the American Society of Echo and the American College of Cardiology have worked together to come up with training guidelines. Gosh, I think they're about four years old now but they're pretty, it was best guesses at the time but I think they'll probably re-revamp, but for anyone who's listening as a program director good idea to think about those things. As we're developing training guidelines for level three and interventional echoes as trainees are going through, I'm old enough to know you have to learn some of this stuff on the fly and not go through a training program. And that brings me to another one, a question though. So we refer to getting, how do you get good at 3D? How do you get the training? And one of the, and we refer to yes, what you do as a fellow, but what do you do if you are a practicing cardiologist in your interventional group now wants you to provide that 3D, that guidance for their interventional procedures but you really haven't got time to step away from your practice or whatever to learn. Have you seen people be successful in learning the skill set without going through a formal training program or other shortened training programs? What would you suggest around that?

Dr. Thaden: Yeah, that's a great question. I think this is probably one of the questions I get asked more than anything but I think that there are a lot of resources available. So whether it's in person conferences, virtual conferences, textbooks. So I will say in speaking, we have a number of CME conferences and basically there's 3D talks at pretty much every every one. I, and I think there's certainly growing interest as the technology has improved and we see how useful it is for certain indications. There's a lot of growing interest. So I think those are great options. And I think the good part about those is you can go and for instance you can go to a conference, you can interact with experts. And what's nice about going to some of these or having dedicated time to see them is that you're able to step away from oftentimes what is a busy clinical practice and dedicate your

attention to actually learning something for those who are really interested in the details. I would say there are a number of textbooks out there but I would say one that was recently published Dr. Malouf, who Dr. Joe Malouf here, was one of the editors along with Dr. Felitra and Dr. Eservathum, it's called Practical 3D Echo cardiography which is an excellent book. I mean, it's just remarkably detailed. And anything you wanna do with 3D is gonna be in that book. Books may not be for everybody, but if you learn well that way that's a fantastic resource. And then another thing that we've done periodically here is often, industry will support hands on training. So if you have a certain vendor that for your ultrasound systems they'll frequently support hands on training whether that's rep coming to your site to help with navology or getting out the computers and the software. And I think that can be really helpful too for those who don't have a lot of experience. But then I think regardless of what you do, after that or before for that first part, the key then is to keep doing it. So you have to be active and intentional and keep working on it because what happens, inevitably, is if you don't have a busy structural practice or you're in a very busy echo lab where 3D isn't done routinely you may only do it every couple weeks or every month and then the skill's gonna be lost. So you have to sort intentionally do it on a regular basis to become sort of facile. And then when you actually need it, you'll be able to do it. But to me, that's probably one of the biggest limitations. You're also busy.

Dr. Klairch: Yeah. I would agree with that at 100%. And I also think just my experience in the last week of trying to learn some new software not on the echo machine so much, but all of these skills that we have that are we're interfacing with technology, repetition, muscle memory, and those types of things are so important as you point out. Well, I think that that really covered this topic well and I'm wondering if there's any last comments you'd like to make about how we use 3D to guide structural heart procedures at Mayo clinic to leave our audience with?

Dr. Thaden: Well, I think we have learned, I mean it's been really interesting to see because I think it's been sort of a coevolution between the structural heart procedures have as we've seen the procedures grow we've seen 3D evolve with it, which has been really cool. And so initially it was Mitra clip or edge to edge repair. And that was kind of where we, I think really used started using more complex 3D. And now as we've moved into the tricuspid procedures, it's really been critical. I mean we probably couldn't do these procedures successfully without 3D in a lot of cases. So it's been really fun to see the two kind of co-evolve and the imaging support the procedure and really to play an active role in it. So I think that that's one thing that's really been fun from a clinical standpoint and it's been gratifying to see patients do well with these procedures.

Dr. Klarich: Great. Well, it's, you've been a leader in our group on this, and I really appreciate all the effort that you've put in and thank you for taking time outta your busy practice today to share some of your thoughts on the use of 3D imaging and the cardiac structural practice. And we'll definitely get you back to talk more about tricuspid develop,

Dr. Thaden: Also evolving, but have a great day and thank you very much and to our audience thank you for taking time outta your day to spend with us talking to the expert.

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