

Speeding Up Cardiovascular Image Reconstruction

Many clinical issues in cardiology such as TAVI planning or the investigation of coronary arteries require very thorough preparation and monitoring. Computed Tomography imaging is increasingly becoming the modality of choice. The help that new functionalities offer in reducing time and effort for radiologists and technicians as well as the standardized images it delivers is very welcome. Two European teams share their experiences.

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Transcatheter aortic valve implantation (TAVI) has become a true alternative to surgical aortic valve replacement. For it to be successful, precise CT images of the complex 3D aortic root anatomy are needed. The decisions on who is eligible for TAVI, which kind of prostheses to select, and how big the device needs to be are based on data from CT imaging. Ultimately, the optimal anatomy-device-interaction determines the success of the procedure. Therefore, TAVI planning is of the utmost importance.



Happy about easier to read images and fewer clicks: radiologist Signe Helene Forsdahl and resident radiologist Frode Tynes of the University Hospital of Northern Norway.

At the University Hospital of Northern Norway in Tromsø, surgeons first began TAVI interventions in 2008. In 2013, radiologist Signe Helene Forsdahl introduced CT imaging for TAVI pre-procedural planning, and by 2017, 112 CT scans for TAVI planning were performed in one year, resulting in 80 successful TAVI procedures. As Forsdahl points out, CT-based TAVI planning can be very tiresome and laborious: “The measurements have been kept on few hands for enhanced quality. It is the radiologist who does all the measurements and image reconstructions.” Understandably so, as it encompasses quite a number of repetitive measurements and images in order to best depict the individual anatomical situation of the patient.

Simplifying preprocedural TAVI planning

“Until two months ago, we moved through these steps manually,” resident radiologist Frode Tynes explains. Step-by-step they would do about 15 measurements of the diameter of the aorta along its anatomical path from the root to the pelvic region. At each step, they would write

Celestial imaging: northern lights in the Norwegian sky.



down the measurements manually, while also initiating and storing about the same number of images along the way. “The total work from opening the examination to finishing the report and processing of all the images including reading the thorax/abdomen/pelvis and “collecting” all the images in a special “TAVI-folder” for the surgeons in our PACS-system takes about 1 hour–1,5 hour.”

Fewer clicks, easier image reading

“With the semi-automation provided by Cardiac Planning and Rapid Results it is a lot faster. A regular examination with good image quality takes only about 40 to 50 percent of the usual time. But what is more important than time saved is that we do not need to click so much anymore. That is the real benefit,” states Tynes. For him, performing the pre-intervention CT planning of TAVI is no longer tiring as the steps are performed directly from the standard CT reconstruction task of the SOMATOM CT scanner in a semi-automated fashion.[1] “The workflow is much more efficient doing TAVI planning the

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Frode Tynes, resident radiologist, University Hospital of Northern Norway, Tromsø

new way,” says Tynes when recalling that he had done five TAVI planning procedures in a row the day before. “That would hardly have been possible before.” With the guidance given by the protocol, this is easy.

For Forsdahl, semi-automation brought yet another benefit: “The semi-automation of the aortic valve has been valuable especially in examination with insufficient contrast and heavy annulus calcification. At the beginning it took time to trust the new software to find the annulus. After double-checking with the familiar, old-fashioned way several times, we now feel very sure about

the results it provides.” All in all, both state that it is a really good thing to get the same quality of results with less work. Considering the time and resources going into TAVI planning, both regard this as a big step forward. With the program being customized to the needs of the Tromsø team, they are getting exactly the measurements, images, and type of presentation they want for their surgeons.

Rapid Results in noninvasive CT coronary analysis

At the Institute for Diagnostic and Interventional Radiology and Neuroradiology at Essen University Hospital, Germany, the situation is somewhat different. The team there consists of 27 radiologists, 26 assistant physicians, and more than 60 technicians. Standardization, automation, and efficiency in image acquisition and reconstruction are key. As Sebastian Blex, Leading Technician and Head of the CT team at the institute, points out, they perform about 80 cardiac CT scans per month, mainly of the coronary arteries, partly for pre-interventional planning of TAVI. “With cardiac CT scans, we try to spare patients from having to undergo an invasive catheter exam,” he states. To do so, they need precise views and data down to the smallest vessel of the coronary tree.

Extra gain: automatic curved multiplanar reconstructions

“Our interest in the new Rapid Results tool was sparked by the fact that it offers the time-consuming curved multiplanar reconstructions (cMPRs) as part of the package,” explains Thomas Schlosser, Assistant Medical Director at the Institute. “It is a big advantage to have MPRs automatically assessed in a robust and reliable way and – what is clinically even more relevant – to have them sent to the PACS automatically. Thereby giving, not only everyone in the team, but also referring physicians access to the data. Many of them do not use syngo.via. Therefore, they would not be able to look at and evaluate

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Happy about time savings: Sebastian Blex, Leading Technician and Head of the CT team (left), and Thomas Schlosser, MD, of Essen University Hospital.

the CT images otherwise.” Besides, the automated visualization provides an opportunity for referrers who are less trained in reading CT images to get a simple and fast overview, while also allowing for an improved interpretation of pathological alterations compared with the normal dataset. “In TAVI planning, where Rapid Results can now generate parallel and radial ranges of the aorta and run-offs, physicians can more easily assess whether to expect complicating issues like plaques, aneurysms, or dissections while implanting the prosthesis.”

Significant time-saving

The key point for Schlosser in using the extensive automated reconstruction function is the significant saving of time. “As the automated reconstruction is very reliable, we hardly ever need to perform manual modifications – the exception being individual anatomical peculiarities like very thin arteries.” Added to this, according to Blex, technicians save up to 20 minutes per case with the reconstruction being done automatically.

Both experts from Essen emphasize the benefit of standardization. For the radiologist, reading the CT images has become easier and faster, which in turn makes reporting easier. For the technician,

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the benefit lies more in not needing to structure the image generation himself. He can rely on the program to guide him. “I only need to double-check the results while following along the arteries and looking for a constriction,” Blex explains. “Besides, there is less room for individual preferences of users within the team, which makes things more reproducible and therefore easier.” ●

Wiebke Kathmann holds a Master’s in Biology and a PhD in Theoretical Medicine. She became a freelance medical writer in 1999 and is a frequent contributor to medical magazines.

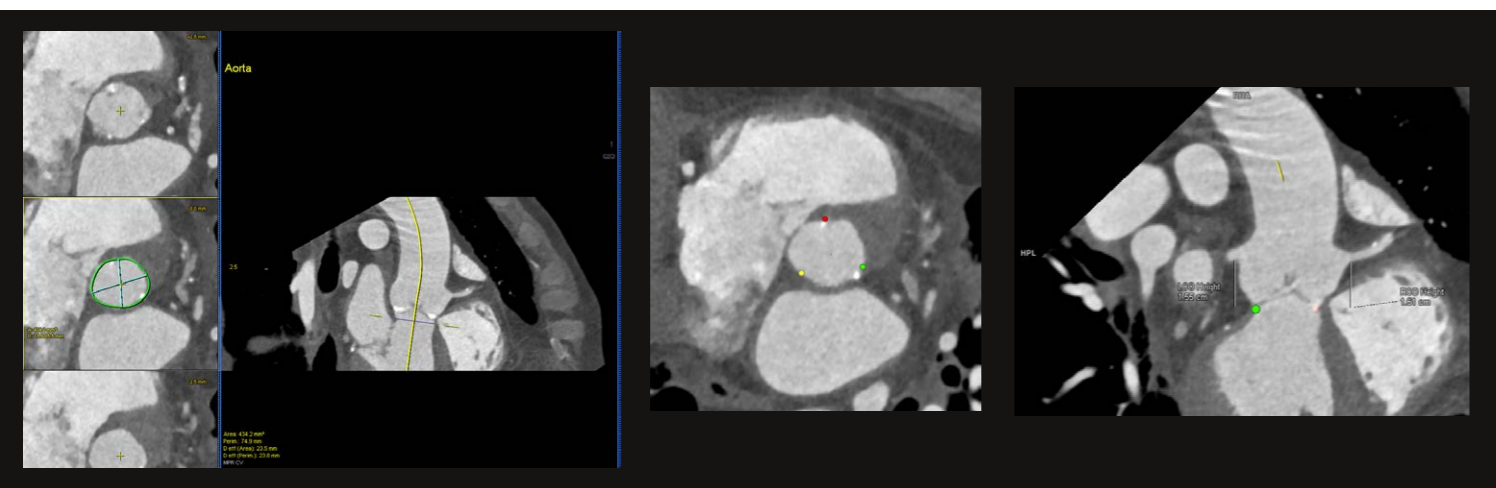
Reference

[1] Horehledova B, et al. Aortic root evaluation prior to transcatheter aortic valve implantation-Correlation of manual and semi-automatic measurements. PLoS One. June 28, 2018;13(6).

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A 63-year-old patient with HCC and known CHD with a previous LAD stent implantation 12 years ago. CT coronary angiography performed as part of LTx evaluation showed a high-grade proximal LAD stenosis (arrow). Courtesy of Essen University Hospital, Germany



A 57-year-old man with lymphoma received aggressive chemotherapy. The assessment with syngo.CT Cardiac Planning and Rapid Results revealed an aortic stenosis and cardiac insufficiency. Courtesy of University Hospital of Northern Norway in Tromsø.