



Harnessing real-time 3D cardiac images

Philips EP navigator for improved visualization

Who/where

Caritas St. Elizabeth's Medical Center,
Boston, MA.

Challenge

Provide Electrophysiologists with accurate 3D anatomical information to assist with confident navigation during long and complex EP procedures.

Solution

EP navigator from Philips, a unique visualization tool that offers electrophysiologists an accurate 3D image of the patient's key heart anatomy, such as the left atrium. With EP navigator a 3D volume, taken from a prior CT scan or 3D angiography, can be overlaid and registered directly on top of the in-room live fluoro display, giving clinicians a comprehensive 3D view of where they are positioning their catheter in the heart in real time.

Millions of people in the US suffer from some form of cardiac arrhythmia. There are 160,000 new Atrial Fibrillation cases, alone, diagnosed each year. As a result, Electrophysiologists face an increasing case load from patients looking for more effective options to treat and manage serious heart rhythm disorders. Caritas St. Elizabeth's Medical Center in Boston, an affiliate of Tufts University School of Medicine, is on the front line of efforts to identify the most effective tools and procedures for clinicians to use in overcoming arrhythmias.

Michael V. Orlov, MD, PhD, Director of Cardiac Arrhythmia Research at St. Elizabeth's, works with some of the very latest electrophysiology (EP) equipment. The EP department at St. Elizabeth's has two dedicated Philips FD10 EP labs. They have Stereotaxis, EnSite, and CARTO as well. Dr. Orlov also points to an extensive and dedicated group of professionals in the department, including two other



Michael V. Orlov, MD, PhD, Director of Cardiac Arrhythmia Research

Electrophysiologists and a support staff of close to 30. Counting both invasive and non invasive cases, St. Elizabeth's EP team performs approximately 1000 EP procedures annually. According to Dr. Orlov, "We treat about 250 Supra Ventricular Tachycardia (SVT) and Ventricular Tachycardia (VT) cases. We are doing about 100 flutter ablations. We do about 300 implants, and the rest is just regular non-complex SVT and VT."

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Looking for Better Results

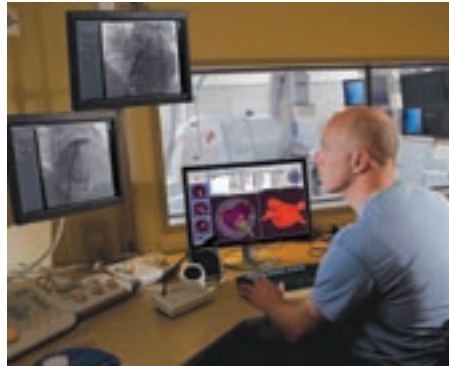
As a major EP center, St. Elizabeth's specialists are constantly looking to uncover new tools, optimize existing tools, and refine processes to enhance EP procedure outcomes. Not surprisingly, the department serves as a testing ground for some of the newest systems from a number of EP manufacturers. The central control room for the two EP labs holds an array of leading edge technology designed to provide physicians with anatomical and electrical information that is critical for accurate and confident navigation during what are often long and complex EP procedures.

As Dr. Orlov explains, “Our mission here is to ensure all this technology is easy to use, clinically applicable, and can be used routinely in procedures. The end result should be a safer and more successful procedure, with better results.”

To help accomplish that mission, Dr. Orlov is working closely with Philips and their dedicated EP business unit. His is one of the first sites to use Philips initial version of EP navigator. EP navigator addresses an area of particular interest for Dr. Orlov; gaining access to as much accurate real time 3D anatomical information as possible during procedures. Dr. Orlov describes why this is important, saying, “3D information adds a certain level of confidence when you do mapping and ablation procedures.”

Adding a New Dimension

With the initial version of Philips EP navigator a prior CT cardiac scan of the patient can be imported into a dedicated



workstation located in the EP control room. Using EP navigator's automatic segmentation, along with human review and fine tuning, a 3D volume of the patient's key cardiac anatomical structures, such as the left atrium and the esophagus, are segmented from the CT image. This 3D volume can then be overlaid and registered directly on top of the live fluoro images, giving clinicians a much more comprehensive view of where they are in the heart, in real time. The 3D overlay synchronized with the X-ray system's C-arm position, so clinicians always have a properly oriented 3D view on their fluoro display. This enhanced display is helpful in determining exactly where a catheter or lead is positioned in relation to other anatomical structures during navigation.

In his initial experience working with EP navigator, Dr. Orlov recalls, “I think when we did the first procedure with EP navigator here it was like a new dimension, because

there was so much new information. The EP navigator added a new dimension in terms of immediately understanding where we are three dimensionally.”

Dr. Orlov describes Philips EP navigator as particularly useful in dealing with SVT where he needs to visualize the left atrium for confident navigation. He also explains that EP navigator can be easily integrated into existing workflow processes, since almost all of his patients receive a routine CT prior to their EP procedures. “The method we use for CT overlay registration takes just a few minutes, it's not that long.” When asked to cite a case where EP navigator was particularly helpful, Dr. Orlov is quick to answer, “We had a case with some very difficult anatomy where we couldn't find a vein. People were thinking that they were somewhere else and I said, ‘No, you are not there.’ And after careful examination and looking more, my opinion was confirmed. And we've had several cases where we were dealing with very difficult anatomy and EP navigator really helps.” Dr. Orlov goes on to explain, “There were quite a few instances where the catheter was tenting, or pushing too much on the wall, and it was pretty obvious from the catheter movements and the overlay CT scan. There was one instance of a perforation that we were able to recognize immediately simply by looking at the overlay of the CT scan.”

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“And we’ve had several cases where we were dealing with very difficult anatomy and EP Navigator really helps.”

Given Dr. Orlov’s clear passion for advancing the field of EP, it’s not surprising that he is rarely satisfied with a single option. Over the last several months Dr. Orlov has been working with Philips on the latest version of EP navigator. This latest version enables him to acquire an image using 3D rotational angiography just prior to beginning the patient’s EP procedure, and use that for the overlay. With this latest version, a true 3D volume image of the heart is rendered on the EP navigator workstation in the control room. The image is then segmented, registered and overlaid onto the live fluoro display for the case. The ability to acquire a 3D volume of the atria was one of the features of the Philips FD 10 that originally appealed to Dr. Orlov. To make this 3D acquisition possible, the X-ray system had to be stable throughout the entire rotation, while being very fast. Dr. Orlov recalls, “I was impressed with the speed of the C-arm rotation; that was one thing that really got me. That, and the considerably smaller amount of radiation that was produced by the C-arm. And while at the time it was only a concept, the 3D atrigraphy was something that was very interesting and I thought about using that as the basis for an overlay.”

Visualizing Key Structures with 3D atrigraphy

Dr. Orlov describes a number of reasons why he likes EP navigator’s ability to use images acquired from the 3D atrigraphy, “To me it was a big advantage to overlay a rotational angiogram, because this is real-time on-line data that you can superimpose on your live fluoroscopy screen.” Dr. Orlov is very pleased with the image quality from

the 3D atrigraphy explaining, “I think everybody who sees the images are very impressed.” He adds that his EP navigator protocols for the 3D atrigraphy acquisition provide whole heart imaging, “So not only are we seeing the left atrium, we see the aorta, I see pulmonary arteries, the right atrium, right ventricle is not difficult obviously, but the left ventricle too.”

“We are also seeing a number of other surrounding structures,” Dr. Orlov notes. “So if we give a little bit of contrast agent into the esophagus, for example, I might not even see it on rotational it is so minimal, but it is enough, the system picks up miniscule differences in contrast intensity compared to the human eye, and therefore you can render it accurately. Visualization of the esophagus is one of the big advantages, but you can also see the spine, and other structures easily,” he says.

For Dr. Orlov, the timeliness of the 3D atrigraphy anatomical information with Philips EP navigator is a major differentiator. “I think the picture taken right before the procedure is more accurate than the one

taken a week or two before the procedure,” he says. Dr. Orlov acknowledges that due to scheduling and insurance issues, CT scans may not be very recent, and may have been acquired at locations with less sensitive CT scanners. Since the 3D atrigraphy images are acquired with the patient positioned on the EP table, Dr. Orlov has great confidence in the accuracy of the EP navigator image and the registration of the 3D volume with the live fluoro during the procedure.

Another aspect of the newest EP navigator release that Dr. Orlov finds helpful for left atrium mapping is a cross section function called EndoView. With EndoView clinicians can make parts of the volume overlay’s exterior transparent, to allow clearer visualization of the endocardiac anatomy. Dr. Orlov explains, “We’re moving out of the veins and going into the atrium. So we need to see the atrium, and the cut out views allow you to see the atrium. You want to see the ostia of the pulmonary veins, you want to see the ridge, the appendage ridge, I think that is very important as well. With the ability to see inside views we are using the EndoView all the time.”



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Dose Savings

Dose is also a consideration for Dr. Orlov. He points out, “The initial data in the literature suggested that the dose a patient receives from a rotational angiogram was about half of the CT dose. We did some recent calculations here and it seems that it is actually much less than that. And my philosophy is always the less dose the better.”

Based on his experience so far, Dr. Orlov is very impressed with the added 3D anatomical information available with Philips EP navigator and believes other EP specialists will find it useful as well. He sights a recent example of the added confidence this information gives him for navigation, “We recently had a patient who did not have a CT scan, for one reason or another. And we used the 3D atriography as the sole navigation tool. The images were so nice we are using them as hand outs at HRS.” Viewing EP navigator as a very useful tool for assisting with difficult anatomy and anomalous veins during procedures, Dr. Orlov says, “With this latest version it is much more realistic because we have a real time image. We are pleased with all these features and are using them for improving the procedures.”

Whether the EP uses a CT scan or obtains a 3D atriography, the three dimensional image overlaid on top of live fluoro may increase the confidence and visualization of critical structures of the heart. Due to this benefit, procure time and dose may also be reduced. EP navigator is an intuitive clinical tool to help guide you in critical EP procedures.



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