

# PERFORMING IMAGE REGISTRATION IN SOUTHERN CALIFORNIA WITH THE CARTOMERGE™ IMAGE INTEGRATION SOFTWARE MODULE

*As more electrophysiologists use the CARTOMERGE™ Image Integration Software Module, they are refining the registration process to suit their particular techniques. This is one in a series of White Papers that have been prepared to share the experts' methods.*

Dr. Kamran Toluie, MD, FACC, FACP, is Director of Cardiac Electrophysiology at Westside Medical Associates, Beverly Hills, California. Working in the electrophysiology laboratory at St. Vincent Medical Center in Los Angeles, Dr. Toluie was the first physician to use the CARTOMERGE™ Module in the Los Angeles area. Since the introduction of the CARTOMERGE™ Module in 2005, Dr. Toluie has used it to perform more than 50 procedures.

After preparation of the CT image, Dr. Toluie's registration technique focuses first on the left atrium and pulmonary veins. Using the NAVISTAR® Catheter, he enters the left atrium and places the catheter distally in the left superior pulmonary vein, dragging the catheter back toward the ostium and creating a tube with the catheter. At the junction of the atrium and the ostium of the left superior pulmonary vein, he acquires two or three CARTO™ XP System surface points, which will later be used to create landmark pairs. As he is acquiring points, he rotates the CARTO™ XP System image to see the location of the points. He repeats the process for the remaining pulmonary veins (left inferior, right inferior, and right superior), creating a tube and acquiring 2 or 3 surface points in each structure. After acquiring points in the pulmonary veins, Dr. Toluie moves the catheter to the left atrial appendage, acquiring points deep in the appendage and on the ostium and anterior wall as an anterior landmark.

Next, Dr. Toluie acquires between 50 and 150 points in the left atrium. "There are two considerations in acquiring points: number and location," Dr. Toluie says. In general, he says, the more points acquired, the more accurate the map will be. However, the location of the points is also important. "If you take only six points, and they are exactly anterior, posterior, superior, and inferior, you will have an accurate map," he says.

The next step is to identify the sites on the CT scan that correspond to the points acquired on the CARTO™ XP System image in order to create landmark pairs. "The pulmonary veins and appendage are easy to identify on the CT scan," Dr. Toluie observes, "and I can easily correlate my landmark points with corresponding sites on the CT scan." In addition to matching the points visually, Dr. Toluie also recommends comparing the distances between points on the CARTO™ XP System image with distances on the CT scan to ensure that the correct structures are chosen for matching. He notes that the tubes created by the CARTO™ XP System for the veins are always the same diameter, regardless of the size of the patient's anatomy.

At this point, Dr. Toluie performs Landmark and then Surface registration. He checks the surface registration statistics to determine the accuracy of the registration. "You are looking for less than 2 mm, or even 1 mm," he notes. "If you see a higher value than that, you need to acquire more points." The variables in obtaining an accurate registration include the size of the atrium, the location of the pulmonary veins, changes to a patient's cardiac anatomy caused by previous surgery, and the depth of the point acquired in the left atrial appendage. Getting points deep in the appendage is a bit tricky, he says, because pushing the catheter might cause perforation.

Dr. Toluie integrates information from several external instruments to ensure the accuracy of catheter placement, including intracardiac echocardiography, fluoroscopy, and the Stockert generator. "I would never do a case without intracardiac echo for several reasons," he says. "First it gives you the best image of the intra-atrial septum. Some patients may have a very floppy or an aneurismal atrial septum, which creates a risk of perforating not only the septum but

also the posterior wall. Echo also allows you to verify the location of the catheter in the pulmonary vein," Dr. Toluie continued. "You can see it with fluoroscopy and with the CARTOMERGE™ Module map, but you confirm it with intracardiac echo." Intracardiac echo also allows you to see if the catheter is "floating" in the left atrium, not making good surface contact, he added. Dr. Toluie also uses the impedance data provided by the Stockert generator to determine the quality of surface contact within the pulmonary veins and left atrium.

For Dr. Toluie, the principal benefit of the CARTOMERGE™ Module is the improvement in accuracy that it provides. He also notes that it allows him to reduce the duration of fluoroscopy use, which reduces radiation exposure. He finds the CARTOMERGE™ Module to be useful in facilitating the EP's ability to visualize the three-dimensional structures of the heart. "Not everyone has the same anatomy," he says. "Pulmonary veins have different takeoffs, or they may have a common ostium, or the left atrium may be unusually small. The CARTOMERGE™ Module allows you to create the geometry in your head and to learn from each procedure." He also shows CARTOMERGE™ Module images to patients to help explain procedures. "They like seeing the image, and they understand it," Dr. Toluie says. "The CARTOMERGE™ Module image helps them feel like they are involved in their own care."

Dr. Toluie urges his colleagues to learn how to use the CARTOMERGE™ Module by observing its actual use in an electrophysiology laboratory. "Reading journal articles is necessary," he concluded, "but you should see the system at work to really understand it."



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