

## —Efforts by Iwate Prefectural Central Hospital—

Engineering Center, Shimadzu Medical Systems Corporation

Miyuki Shoji

Due to the increasing complexity and sophistication of treatments for arrhythmia in recent years, there is a demand for angiography systems capable of reducing exposure, reducing contrast media usage, and reducing examination times. Shimadzu's latest angiography systems, the Trinias series, feature various unique functionality for achieving a minimally invasive experience.

This article describes the minimally invasive procedure practices at the Iwate Prefectural Central Hospital where a Trinias series system was introduced.

### 1 Application of an Ultra-Low Dose Fluoroscopy Mode

One non-pharmacological treatment for arrhythmia is catheter ablation, but the procedure is often time-consuming and results in higher X-ray dose levels to patients and physicians. Therefore, the procedure requires consideration for minimizing fluoroscopy dose levels.

There are two main methods for reducing the X-ray dose during fluoroscopy, either (1) reduce the pulse rate or (2) reduce the dose per pulse. Trinias systems offer a low-dose mode that uses both methods (1) and (2) to reduce the X-ray dose rate by about 44 %, compared to the normal fluoroscopy mode. Additionally, an extra-low dose "ExLow" mode using X-ray control for pediatric protocols can reduce X-ray dose rates by about 63 %.

The Iwate Prefectural Central Hospital uses the ExLow mode and a low 5 pps pulse rate mode for catheter ablation procedures to keep X-ray dose levels as low as possible. That reduces the X-ray dose rate by about 81 % (Fig. 1).

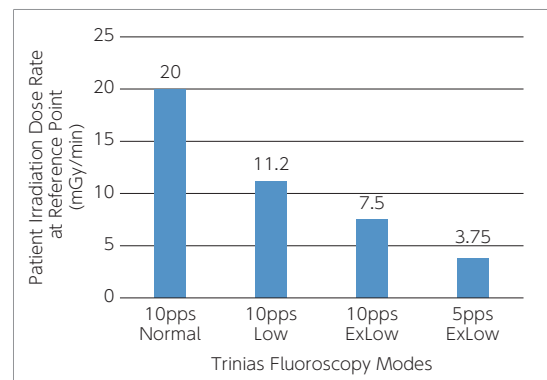


Fig.1 Comparison of Radiation Dose rate by Fluoroscopy Mode

Patient irradiation dose rate at reference point with 8-inch FOV and 20 cm acrylic phantom.

\* Measurement data that appears in Shimadzu's clinical manual. The 5 pps value has been calculated.

### 2 Application of Fluoroscopy Record Function

In the case of radiofrequency catheter ablation, the ablated locations on the heart muscle must be recorded many times. We use the fluoroscopy record function for that recording process. Conventional DA radiography and OneShot



#### A Word from Hideaki Endo, M.D., Ph.D., Chief of Cardiovascular Internal Medicine

At our hospital, the SCORE Navi+Plus application, which produces 3D roadmaps using CT images, is used for cryoablation procedures. Using some of the features given in this article, CT images can now be accurately overlaid on the fluoroscopy images. It provides anatomical information as good as a 3D mapping system, allows us to quickly select appropriate pulmonary vein procedures and helps reliably achieve pulmonary vein isolation. Based on these features, it can be expected to shorten fluoroscopy time greatly, and it will be a useful tool for balloon ablation, which is expected to become more widely used in the future.

radiography could also be used for recording ablations, but that would increase the X-ray dose level. By using the fluoroscopy record function after watching the catheter tip by fluoroscopy, additional X-ray doses can be eliminated, which results in lower X-ray dose levels.

Fluoroscopy images can be recorded from either the control room or from a bedside console without time loss. Also, it is unnecessary to switch the mode before the start of the next fluoroscopy, so that the procedure can be performed smoothly.

### 3 Application of SCORE Navi+Plus

At the Iwate Prefectural Central Hospital, the SCORE Navi+Plus application, which produces 3D roadmaps using CT images, is used for cryoablation procedures.

The following measurements are taken at the time CT images are acquired for SCORE Navi+Plus. (1) They use a flat headrest as much as possible for CT scan, similar to headrests used for angiography. (2) Arms are not raised during scans. (3) Patients are scanned with multiple markers applied to their body surface, so that the markers can be used as reference points when overlaying CT and fluoroscopy images. (4) As far as possible perform the CT scan on the day before the examination.

Since the two images from different modalities need to be overlaid, a different method than for regular CT scans is used for (1) and (2), so that body locations can be aligned more easily. Puncture markers (**Fig. 2**) that do not cause artifacts in CT images are used for (3) and are also selected for cost considerations. In anticipation that markers might fall off, marker locations are also marked with a marker pen.

After scans, the CT system is used to generate data excluding the left ventricle, which is loaded into the SCORE 3D workstation, so that various VR images (left atrium, bronchi, and vertebral bodies) can be immediately generated at the workstation (**Fig. 3**).

Registration (alignment between CT and fluoroscopy images) is required if SCORE Navi+Plus is used, so the Iwate Prefectural Central Hospital uses markers at PA/RAO50° locations and the bronchial bifurcation as reference points for registration. Affixing the markers helps with understanding the vertical positional relationship between vertebral bodies, respective magnification rates, and so on (**Fig. 4**).

During procedures, a single click is required to switch between front and back views. In addition, VR images can be adjusted while in the roadmap mode and roadmap images automatically track C-arm rotation movements to prevent inhibiting the progress of procedures and help shorten examination times (**Fig. 5**).

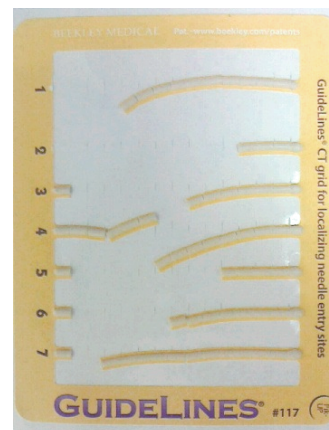


Fig.2 Marker (made by BEEKLEY MEDICAL)

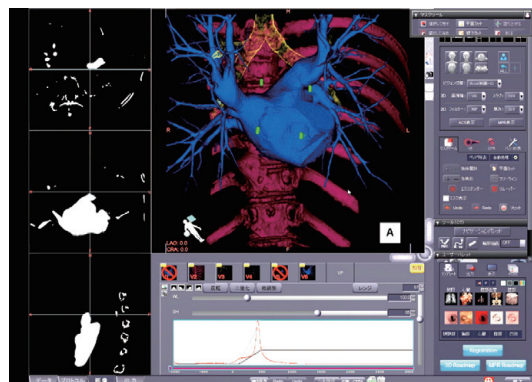


Fig.3 Volume Addition

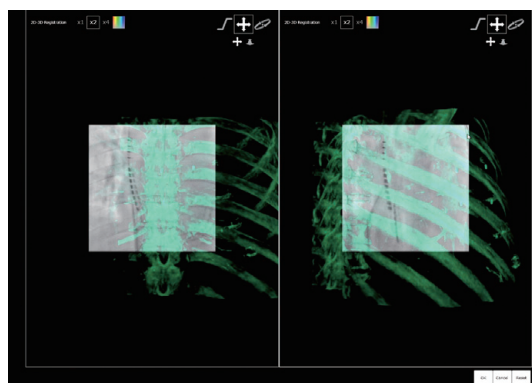


Fig.4 Image Registration

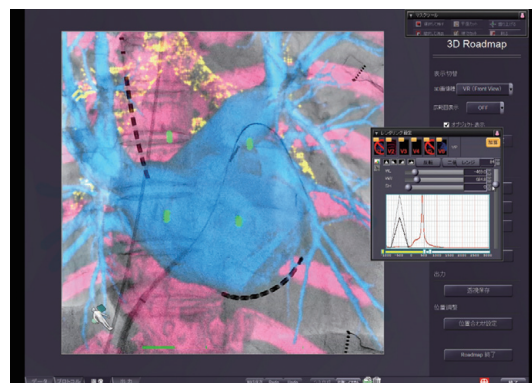


Fig.5 3D RoadMAP