

—Efforts by Kokura Memorial Hospital—

Medical Systems Division, Shimadzu Corporation

Hiroyuki Kinoshita

With the increasing complexity and sophistication of lower extremity EVT, there is a demand for angiography systems capable of reducing radiation exposure, reducing contrast media usage, and shortening examination times. Shimadzu's latest angiography system (Trinias series unity edition) includes a variety of functions that support minimally invasive procedure under the concept of "MiX" (minimally invasive experience). SCORE RSM (hereinafter RSM) is one of these functions that assists minimally invasive and efficient lower extremity EVT, along with functions named Road Map, Measurement Tool, and Peak Hold.

This article describes the efforts of Kokura Memorial Hospital (Fukuoka Prefecture) in their application of these 4 functions during clinical practice.

1 Using RSM and DSA Based on Respective Strengths

When performing lower extremity EVT, it is important to ascertain the hemodynamic status of the entire lower extremity, and not just the detailed hemodynamic status of the area around the lesion.

At Kokura Memorial Hospital, the optimal images for the situation are acquired by using RSM for injecting contrast medium into the entire lower extremity, and DSA for injecting contrast medium into lesions with no movement in the field of view. RSM is a Shimadzu proprietary imaging program capable of reducing the visibility of background information in DSA images with frequency subtraction processing. RSM differs from DSA by processing each frame independently and being extremely resistant to movement effects. These characteristics allow it to perform bolus chase angiography for an entire lower extremity in a single attempt. Another strength of RSM is the ability to ascertain the positional relationship of vessels and bone. Furthermore, since the radiation dose per pulse is around 25 % that of DSA, the RSM imaging program is also effective at reducing radiation exposure. DSA uses a mask image to subtract the background image completely, which allows it to acquire more detailed vascular information at the procedure site.



Using RSM and DSA During the Same Procedure

Left: Using RSM to check overall hemodynamics by bolus chasing below the superficial femoral artery (SFA). Right: DSA image. Details vascular information was obtained by imaging the foot and region below the knee.



A Word from Mr. Ryouji Ichinose, General Manager Radiological Technologist

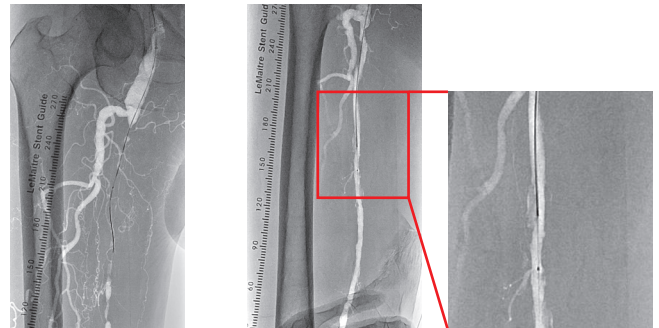
Since having systems with image intensifiers, when imaging lower extremities we have always used Shimadzu's proprietary RSM imaging program to first conduct an overall check of the entire area. DSA imaging is then performed during procedure. DSA images are first used to make essential preoperative measurements, then used again as Road Map images during wiring and ballooning. Since the Peak Hold function was introduced, it has become a familiar tool because of the substantial effect it has in reducing contrast media use and fluoroscopy rate. All applications are necessary for the performance of EVT, and our aim is to utilize these applications efficiently.

2 Using Road Map

When penetrating a chronic total occlusion (CTO) lesion, it is important to manipulate the wire so it passes along the assumed path. However, for operators it can be somewhat cumbersome to change their line of sight and look away from fluoroscopy images on the live display monitor to view reference vessel images on a reference monitor, all while handling devices.

At Kokura Memorial Hospital, Road Map is used during these procedures. The Road Map function overlaps a reference image of vessels that was acquired by earlier contrast media injection over live fluoroscopy images. Road Map gives the operator the ability to confirm the vascular path and occlusion exit point at any time within live fluoroscopy images, allowing the operator to concentrate on the procedure.

Road Map is sometimes also used during IVUS. Road Map is an extremely effective observation aid that allows the operator to use fluoroscopy images to confirm which part of the vessel is being displayed by IVUS.



Using Road Map in a Case of SFA CTO

Left: Aiming to penetrate the occluded area while verifying the exit point
Right: Performing Road Map fluoroscopy during IVUS

3 Using Measurement Tool to Assist the Operator

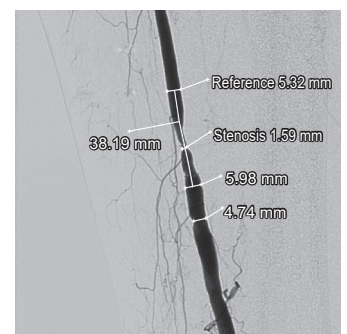
At Kokura Memorial Hospital, the Measurement Tool function is used after DSA imaging to quickly perform vascular measurements and aid rapid decision-making by the operator. Specifically, Measurement Tool is used to measure vessel diameter at narrowed areas, reference vessel diameters at proximal and distal ends of narrowed areas, lesion length, and perform other measurements on images.

Manual QCA results
Reference mm: 5.32
Stenosis mm: 1.59
Stenosis ratio %: 70.2

Calibration factor:
0.235 mm/pixel

Vascular Measurements in a Case of SFA Stenosis

Vessel diameter at the stenosis, reference points, and the lesion length are measured.
Note: IVUS and OCT are used for reference information when deciding device size.

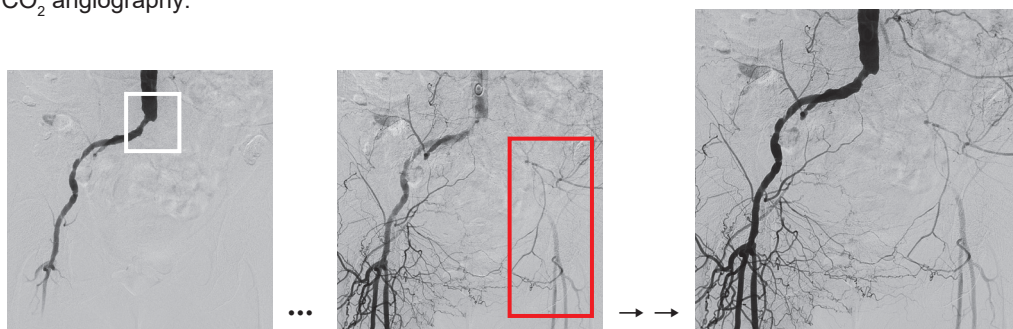


4 Using Peak Hold

For cases of CTO, while it is important to obtain an accurate understanding of entry and exit points for the occluded area, when blood flow to the distal side of an occlusion is slow, it is often difficult to obtain contrast enhanced images in which the both the proximal and distal sides of an occlusion are simultaneously filled with contrast medium.

At Kokura Memorial Hospital, they utilize the Peak Hold function to assist in this area. Peak Hold follows the path of contrast medium in DSA images (the area in each frame that displays the highest concentration of contrast medium), and displays this path on a single image. This provides the operator with an image that allows them to simultaneously see the entry and exit points for an occlusion. Furthermore, this Peak Hold image is used together with the Road Map function to perform more effective road map fluoroscopy.

At the hospital, CO₂ angiography is often used in patients with deteriorating renal function, and they also use Peak Hold during CO₂ angiography.



Using Peak Hold in a Case of Iliac Artery CTO

By processing frames obtained from when the proximal part of the lesion is easily visible, up to when the distal part of the lesion is easily visible, an image can be acquired that shows both the entry point (white box) and exit point (red box) simultaneously full of contrast medium.