Minimally Invasive Procedures in Practice
—Effort by Fukuoka Kieikai Hospital Part 1—

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Given the increasingly complex and sophisticated interventional procedures in recent years, users are requesting angiography systems that can achieve lower X-ray dose levels, less required contrast agent, and shorter examination times. Shimadzu's latest Trinias series angiography system features various functionality for achieving minimally invasive procedures.

To highlight uses of various functionality for neurointerventional radiology, this article is the first of two parts describing the measures at Fukuoka Kieikai Hospital.

1 Using the Virtual Stent Function

Fukuoka Kieikai Hospital uses the virtual stent function for carotid artery stenting (CAS). The virtual stent function displays virtual stents in blood vessels shown in a 3D images, based on the specified stent size (length and diameter). Unlike functionality that only performs measurements, this function enables visual confirmation of the stent implant location and post-implant coverage range **(Fig. 1)**.

Fukuoka Kieikai Hospital not only anticipates using the function for CAS procedures, but also for stent-assisted coiling of cerebral aneurysms **(Fig. 2)**. For such procedures, it is extremely important for the stent to adequately cover the neck portion of aneurysms, which can be confirmed visually using a virtual stent. We received feedback that It tends to overestimate the length in a bent vessel, but being able to visually confirm the coverage with a virtual stent is more than adequately beneficial."

Fig. 1 Example of Using Virtual Stent Function for Stenosis at the Origin of the Internal Carotid Artery

2 Utilizing Blood Vessel Measurement Functionality

In many cases treating cerebrovascular diseases , such as carotid stenosis or cerebral aneurysms, requires measuring vessel diameters and distances in multiple locations.

Normally, such diseases are measured using relatively simple distance measurement functionality, but Fukuoka Kieikai Hospital uses the vascular measurement functionality in SCORE 3D workstation, especially for CAS procedures. That functionality automatically analyzes the major and minor diameters at any cross section of the specified blood vessel and the distances
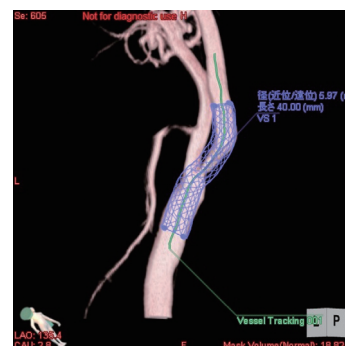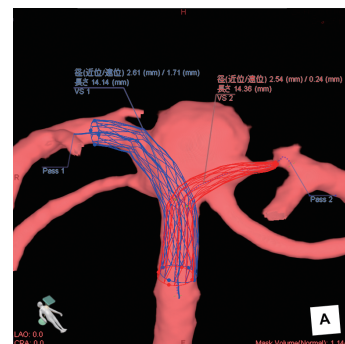

Fig. 2 Illustration of Using Virtual Stent for Coil Embolization of Cerebral Aneurysm

A Word from Osamu Ito, M.D., Ph.D., Department of Neuroendovascular Surgery

After using the Trinias series unity edition angiography system for the first time, I was very surprised by the excellent image quality. When I learned that it is based on Shimadzu's proprietary state-of-the-art image processing technology, such as Flex-APS,[a] it really renewed my appreciation for Shimadzu's high technical capabilities.

We are also very satisfied with the excellent functionality and user-friendly operability of the 3D workstation software featured in this article (SCORE 3D workstation). Needless to say, the high image quality and image guidance function will result in more advanced interventional procedures. I also look forward to additional system advancements being introduced in the future.

[a] (Excerpt by Editorial Team) References: Shohei Okubo et al. Shimadzu Review, Vol. 74, No. 1 and 2, pp. 81-84, 2017

between measurement points and then displays a summary of the measurement results within a single screen **(Fig. 3)**. In the case of CAS procedures, for example, it can also simultaneously analyze the blood vessel diameter at the lesion area, the vessel diameter at a reference point, the distance between reference points used to determine the length of the stent to be implanted, and the vessel diameter at the position where the protection device is to be implanted. Specifying the blood vessel to be analyzed involves simply plotting two points.

We received feedback that "The functionality is very convenient, because almost all the information necessary for treatment can be understood at a glance using simple operations using that functionality." The functionality can also be used to analyze stenosis.
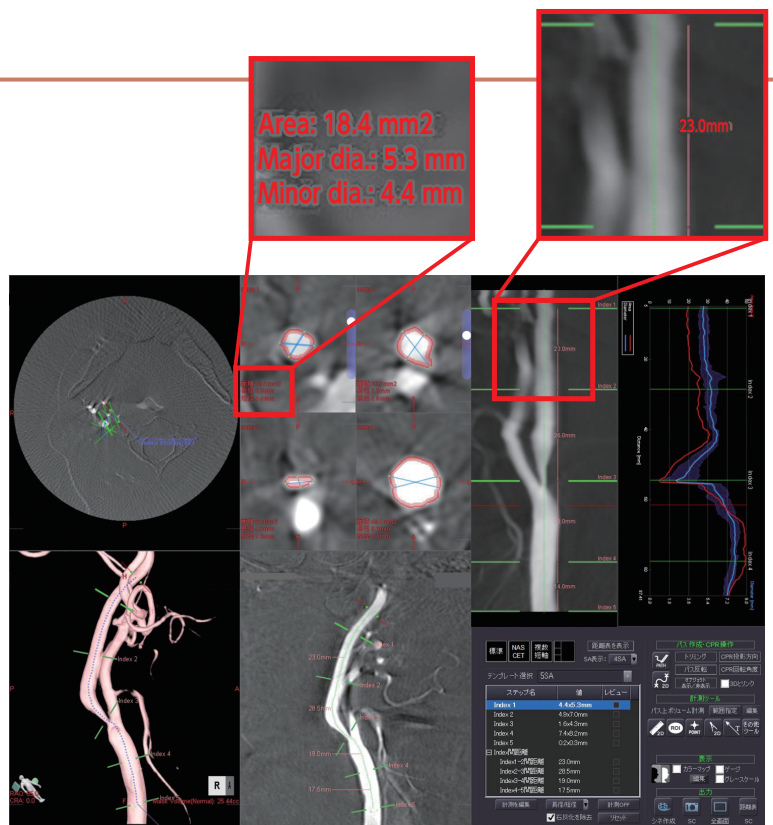

Fig. 3 Vascular Measurement Screen
This screen includes a consolidated display of axial, 3D, short axis MPR (cross-section along short axis), CPR, straight view, and diagram images. Also, measurement points are indicated in all views to enable easier visual confirmation.

3 Utilizing Multiple Functions for Reviewing Working Angles

Using an appropriate working angle for coil embolization of cerebral aneurysms is an important element for maximizing therapeutic benefits. Furthermore, because the angle is determined during the procedure on the day of surgery, it needs to be determined as quickly as possible.

To determine the appropriate working angle quickly, Fukuoka Kieikai Hospital uses a combination of two functions. The first is the 3D image transparent display mode **(Fig. 4)**. The transparent mode displays blood vessels with semi-transparency, which is helpful for understanding how the blood vessels overlap in the depth direction. The second is the 3D dual-display mode. Trinias series systems can simultaneously display up to four 3D images, but they use the dual-display mode to quickly decide the working angles of both planes on the same screen **(Fig. 4)**.

They also use three rotation dials for angle adjustments **(Fig. 4)**. Because 3D images can be freely rotated using the mouse, it may seem difficult to determine the working angles while taking into consideration the C-arm movement range. In contrast, it seems much easier to determine working angles while taking into consideration the C-arm movement range by using the dials, which enable the angle to be adjusted to only one direction. Once working angles are determined, the angle transmission function is used to send the angles to the C-arm.*1 Specifically, the workflow consists of "using the left-right dial to adjust the orientation around the body axis (LAO/RAO), using the up-down dial to adjust the orientation in the body axis direction (CRAN/CAUD), using the mouse to make fine adjustments to the working angles, and then sending the angles to the C-arm." The workstation software also includes an angle memory function that can record multiple working angles for easy recall later **(Fig. 5)**.

Fig. 4 Dual-Display and Transparent Display Modes
The frontal plane working angle is determined on the left side and the lateral plane working angle is determined on the right side. The dials are located in the lower right corner of respective views and can be used to adjust the corresponding angles in longitudinal and lateral directions.
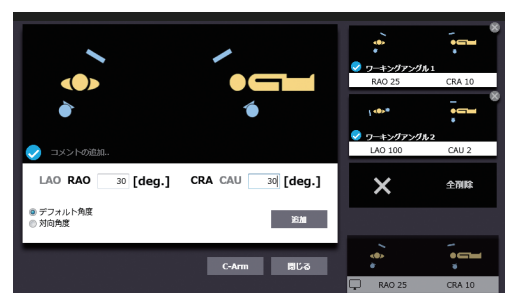

Fig. 5 Angle Memory Function
Angles can be recorded in the thumbnails on the right.

*1: The angle transmission function is only enabled for the frontal C-arm.