Experience of Using the BRANSIST safire VC17 Angiography System Equipped with a 17 × 17-inch FPD

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1. Introduction

Our hospital is situated on the western edge of Aichi Prefecture. It functions as a foundation hospital for a region not only containing the medical district of Ama and Tsushima but also stretching as far as the western part of Nagoya City and part of the northwest area of Mie Prefecture.
The hospital was founded in August 1943 by the Kainan Federation Responsible for Health Care Purchasing Cooperatives as a group hospital for local residents, with departments of internal medicine and trauma, and 20 beds. In 1948, control of the hospital was transferred to the Aichi Prefectural Welfare Federation of Agricultural Cooperatives, and to this day, we continue to provide medical care based on the needs of the local community.
In February 2003, a new inpatient wing currently equipped with 553 beds (including those in the ICU, the convalescence/rehabilitation ward, and the palliative care ward, and those for patients with infectious diseases) went into operation. The Department of Radiological Technology is situated on the first floor of the new wing. Most of our equipment is also kept in the new wing, although we have set up two general radiography rooms, one MDCT scanner, and one urological system in the outpatient ward, where we use them in the day-to-day treatment of patients.

2. Background to Introduction of BRANSIST safire

We used to conduct angiography with a setup consisting of two systems: a dual-plane system (for the abdomen and limbs) and a bi-plane system (for the head and heart) equipped with image intensifiers. However, because of the deterioration of the dual-plane system and a yearly increase in the number of cardiac catheter examinations and head examinations, we introduced Shimadzu's BRANSIST safire HB9 (for the heart) bi-plane system equipped with a direct-conversion 9 × 9-inch FPD, and because of the desire of doctors to be able to observe a wide range surrounding the region of interest in a single image, we introduced Shimadzu's BRANSIST safire VC17 equipped with a large-field direct-conversion 17 × 17-inch FPD.

The VC17 was the first angiography system in the world to be equipped with a 17 × 17-inch FPD, and the very first model was introduced at our hospital in August last year. I would like to describe our experience of using it.

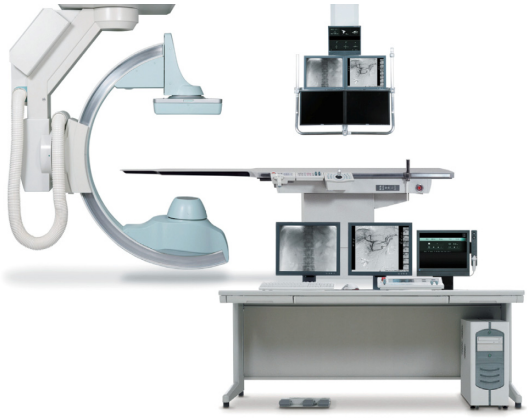

Fig. 1 17×17-inch BRANSIST safire VC17 (Ceiling-Mounted Type)

3. System Overview

This system incorporates a ceiling-mounted C-arm equipped with a 17 × 17-inch direct-conversion FPD, and is capable of performing DA, DSA, RSM-DSA (Real-time Smoothed Mask DSA), Rotational RSM-DSA (precessional movement and pendular movement), and 3D-DSA (of the head and abdomen). Five field sizes can be used: 17, 15, 12, 9, and 6 inches **(Table 1)**. The fluoroscopy and radiography rates are shown in **Table 2**. Fluoroscopy rates of 3.75, 7.5, 15, 15H, 30, and 30H can be selected. Regarding radiography, although different times and rates can be combined freely in accordance with the needs of the facility, it is not possible to change the rate during an X-ray exposure. This is one point that I think requires modification.
With Rotational RSM-DSA, precessional movement is performed with a fixed deflection angle of 30º and a cycle of 6 sec (3 cycles max.), and pendular movement is performed in a fixed range of LAO15º to RAO15º, also with a cycle of 6 sec (3 cycles max.). These functions enable the 3-dimensional observation of blood vessels.
The maximum rotation speed of the C-arm in 3D-DSA when it is set behind the head is 60º/s.

Item	Specifications
Conversion method	Direct
Total number of pixels	3,072 × 3,072
Effective number of pixels	2,880 × 2,880
Acquisition rate	30/15/7.5/5/3/2 fps
Effective field size	17/15/12/9/6
Pixel pitch	150 μm
Dynamic range	14 bits

Table 1 17-inch FPD Specifications

	f/s	Exposure time (s)
Abdomen and limbs	2	30
	3	20
	7.5	20
	5	20
RSM (Rotational RSM)	15	20
	15	40

Table 2 Acquisition Rates at Our Hospital

4. System Features

4.1. Automation of Aging and Calibration

One superior aspect of this system is that it can automatically perform the aging and calibration that is required before use. With previous systems, aging had to be performed for both fluoroscopy and radiography by manually changing the voltage, and it was necessary to move the C-arm to the center position and remove the grid before performing calibration. With this system, aging is performed automatically when you press the start button, and automatic calibration can be initiated by simply checking that the SID is 110 cm in the standby position and pressing the start button. This makes it possible to allocate more time during the busy morning period to other tasks.

4.2. Whole-Body Coverage

Another advantage is that examinations can be performed with the C-arm set behind the head, at the right or left side, or in one of the intermediate positions as appropriate for the circumstances or application **(Figs. 2 to 4)**. At our hospital, abdominal examinations are performed with the C-arm on the left side of the patient, with the C-arm moved to the head to perform 3D-DSA. Upper-extremity PTA is performed with the patient's arm pointing out to one side and so, in order to make it easy for the physician to perform the procedure, the C-arm is set behind the head. I think that the intermediate position can be used in head examinations, for example, when intubation is performed on a patient with a decreased level of consciousness and the physician needs to place objects alongside the patient's head. The C-arm rotation angle ranges are shown in **Table 3**. Regardless of the setting position, there are no significant restrictions on bed movement distance and C-arm rotation and so examinations can be performed across the entire body with few problems.

The ceiling-mounted C-arm has a large range of movement covering 160 cm in the transverse direction and 287 cm in the longitudinal direction. This makes it easy to handle brachial, radial, and femoral approaches, and radiography of the lower limbs can be performed easily without having the patient lie in the opposite direction. Incidentally, my height is 176 cm, and there is easily enough movement to perform radiography on any area of my body, right down to my toes. The 17 × 17-inch FPD enables simultaneous radiography of both legs, which helps save contrast medium.

Fig. 2

Fig. 3

Fig. 4

Position	Angle
Left-side position	RAO90º to LAO60º
	CRA45º to CAU45º
Intermediate position (left/right)	RAO90º to LAO90º
	CRA45º to CAU45º
Head-end position	RAO120º to LAO120º
	CRA45º to CAU45º
Right-side position	RAO60º to LAO90º
	CRA45º to CAU45º

Table 3 C-Arm Rotation Angle Ranges

4.3. Operability

The Safire-series "Cyber Grip" controller enables one-handed execution of C-arm rotation (25º/s max.) and movement, vertical movement of the FPD, and table movement. The "Direct Memory" auto-positioning function allows angle setting and angle registration to be performed with easy operations. Operators have described these features as being extremely easy to use once they got accustomed to them.

These operations can be performed from an operation room, from where it is possible to support the operator.

4.4. Monitors

There are independent live and reference monitors, and images can be referred to at any time, even during radiography or fluoroscopy, on the reference monitor. This monitor can also be used for image processing and measurement. Selected images can be displayed or replayed instantly, which has helped eliminate one source of stress during examinations. There is also an image viewer that is used for post-processing. Images can be transferred to this viewer immediately after they are obtained, allowing them to be processed while continuing the examination. This is an extremely convenient feature.

4.5. Safety

The system design reflects consideration of safety, with a contact sensor on the front of the FPD and noncontact sensors on all four sides. When we first introduced the system, the sensitivity of the noncontact sensors was too high, and they would be activated, disabling C-arm operation, simply by the operator standing. Such problems, however, were soon resolved.

4.6. IVR Shuttle

With this system, operations that were previously performed with a mouse and keyboard, such as switching of the fluoroscopy/radiography rate, the selection and playback of reference images, and image processing, can all be performed with an IVR shuttle. This makes it easy to support the operator, and helps facilitate the smooth execution of examinations and treatments.

4.7. S.I.M. (Super Impose Map)

From the time the system was first introduced, it was possible to create map images in fluoroscopy. To fulfill the desire to be able to perform treatment using map images with DSA images, the system was upgraded.

Although this function has helped to increase the efficiency of examinations and treatments and to reduce the consumption of contrast medium, the procedure for creating map images from radiography images is a little complicated, and needs to be simplified.

5. Image Quality

Regarding radiographic images, not only does the direct-conversion method give extremely sharp images, the FPD pixel pitch of 150 µm makes it possible to obtain high-definition images that allow even peripheral blood vessels to be observed with ease **(Figs. 5 to 7)**. Doctors have praised the quality of clinical images.

Regarding fluoroscopic images, it was noted at first that the tips of microcatheters could not be visualized, but this problem has been resolved by the installation of the image processing engine SUREengine.

Fig. 5

Fig. 6

Fig. 7

6. Summary

The large field size of this angiography system equipped with a 17 × 17-inch FPD is effective for observing both the liver and spleen at the same time and for dealing with conditions requiring a large field such as gastrointestinal bleeding.

On the other hand, there are some problems that are caused by the wide FPD unit. For example, moving the FPD too close to the patient can obstruct the procedure. I think that such problems can be solved, however, if technologists provide operators with the support appropriate for the circumstances.

This system is equipped with many functions, and can be used effectively for the whole body.

Since introducing this system, we have gradually had modifications and upgrades made in accordance with our needs. There are still some modifications that I would like to see, and I hope that communicating these to the manufacturer will lead to the development of an even better system.