

Experiences Using Shimadzu's General Radiography System



Mr. Masumitsu Akiyama

Department of Radiology, Diagnostic Imaging Center
Osaka General Hospital of West Japan Railway Company
Masumitsu Akiyama

1. Hospital History

Our hospital was first established in 1915 as Japan National Railways (JNR) Kobe Railway Hospital in Kobe City with the purpose of maintaining the health of JNR employees and their families. In 1928 the hospital was renamed Osaka Railway Hospital, and in 1929 it was relocated to Tennoji in Abeno Ward, Osaka City. Amid calls for privatization of JNR, in 1982 the hospital started treating patients from the general population. With privatization and separation of JNR in 1987, the hospital became an affiliated institution of West Japan Railway Company. Finally, in December 2000, the hospital relocated to Matsuzaki in Abeno Ward, Osaka City (Fig. 1 and Fig. 2). The hospital has 320 beds, 19 medical departments, complete medical checkup facilities, a site area of around



Fig.2 Abeno Harukas Building

9,500 m², architectural area of around 25,000 m², 9 aboveground floors of reinforced concrete (earthquake proof) and 1 floor below ground. The hospital is currently involved in reforming itself based on "organizational strengthening through local medical coordination" and "optimization of hospital function in step with the times," taking place under the philosophy of "Respecting humanity, and providing medical care with humility and sincerity."



(a)



(b)

Fig.1 (a) Hospital Exterior View and (b) Reception

2. History of Installation

Two years ago, our hospital replaced its general radiography system for the first time in 16 years. The previous system was made by Shimadzu (UD150B-30, etc.), and a CR system made by another company. The old systems were replaced due to aging and to migrate from CR systems to FPD systems. Our priorities for selecting a new system were operability, efficiency, and compatibility with different flat panel manufacturers. Efficiency was considered important because of increased patient waiting times for examinations during busy periods, and the complaints we received from patients as a result. We tried increasing efficiency through improvements in the imaging environment and procedures, but as the number of radiological technologists required and time needed for scanning with CR systems became factors, we reached a

limit to how much waiting times could be reduced. In addition to this, operations became progressively busier with an increased number of orthopedic doctors (4 to 8), dramatic increase in imaging orders per patient from orthopedic doctors, and a particularly notable increase in the number of orders for whole spine radiography from 2 directions or for long view radiography of the lower extremities (Table 1). Image quality, safety, durability, and price are all important factors in equipment selection, but on this occasion we felt that better ease-of-use for technologists in the field would improve the experience for patients and have a positive effect on the doctor requests.

In light of this, we looked at the FPD general radiography system that combined Shimadzu's general radiography system and Fujifilm's FPD system. The radiography unit and FPD system were developed together by the 2 companies, and used a standardized radiography protocol and compatible irradiation field. However, what really caught our attention was the auto stitching radiography and auto positioning function.

To date, we had performed long view radiography by loading 2 or 3 imaging plates (35 × 35 cm or 35 × 43 cm) into an long view cassette, and then reloading the imaging plates into a 35 × 35 cm or 35 × 43 cm cassette for use with an CR system. Performing a single long view radiography took around 5 minutes with this system. Meeting consecutive orders for lower extremity long view radiography plus whole spine radiography from 2 directions plus extra orders for each individual patient required substantial effort on the part of the radiological technologist in charge. This time, we had the opportunity to view the newly developed auto stitching radiography system at another hospital. The automatic 3-shot exposure method used for auto stitching radiography was extremely impressive, and led to our decision to purchase the system. We had concerns about where to install the dedicated auto stitching radiographic stand, how to manipulate the stand,

and how difficult it would be for patients to mount and dismount the stand and maintain posture. We also considered it necessary to validate for distortion, positional misalignment, and other issues in images from the system.

3. Experience Using Auto Stitching Radiography

These circumstances led to the introduction of Shimadzu's radiography system for our hospital in March 2015. Although the dedicated radiographic stand is imposing, we had no problem finding space for it in our radiography room (Fig. 3). The instrument moves smoothly and was easy to configure both during radiography and when moving it in front of the stand. The stand has large handles on either side that are sturdy enough for patients to rely on them while mounting and dismounting the stand with ease. The handles are also effective for maintaining posture. Whole spine radiography standards recommend that vertical radiography is performed in a standing position without the use of handles, but at a minimum the handles are a safety feature that helps in maintaining body position. For whole spine radiography, preparing the radiography involves matching the start point to the patient's superior orbital margin, the end point to the patient's groin, then pressing the set button to prompt the X-ray tube and stand bucky unit to automatically align to the radiography start positions. Next, pressing the exposure switch will result in 2 or 3 exposures performed during movement of the bucky unit, and after just 5 seconds the examination

Table 1 Long View Radiography and Auto Stitching Radiography Cases Over Time

Year	Whole Spine Cases	Lower Extremity Cases	Total
2011	7	65	72
2012	6	122	128
2013	63	102	165
2014	323	163	486
2015	632	285	917
2016	759	251	1010

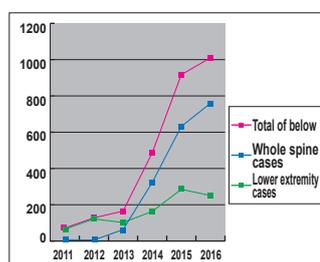


Fig.3 Auto Stitching Radiography Stand

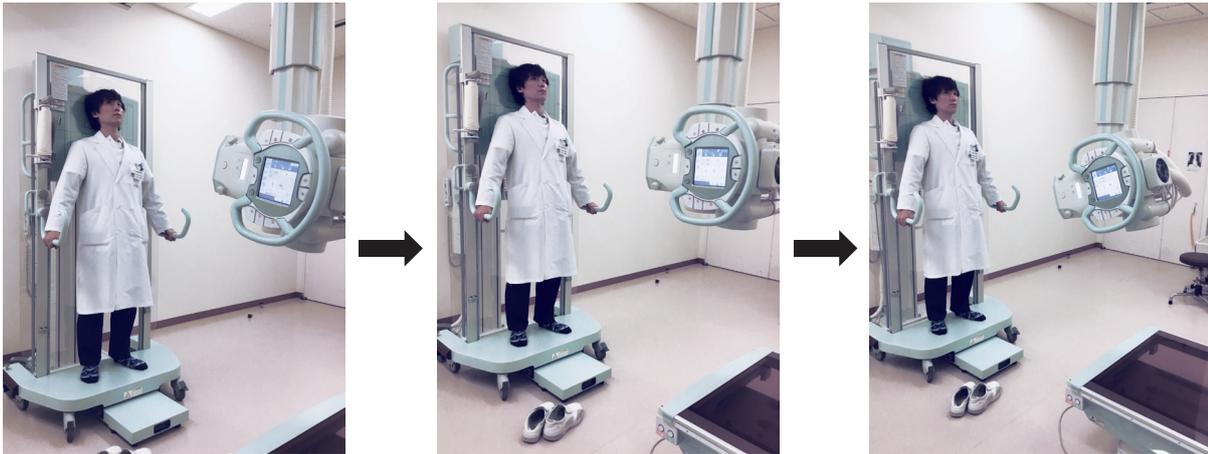


Fig.4 Auto Stitching Radiography

is complete (**Fig. 4**). To perform subsequent radiography of the lateral side, pressing the set button again immediately returns the X-ray tube and bucky unit to their starting positions. Almost the exact same procedure can also be used to perform quick and easy auto stitching radiography of the lower extremities. Whole spine radiographic images are displayed on the DR monitor 3 to 5 seconds after radiography, which allows immediate appraisal of imaging success. Density and contrast levels are almost always appropriate, and manual adjustments are not particularly difficult to implement (**Fig. 5**).

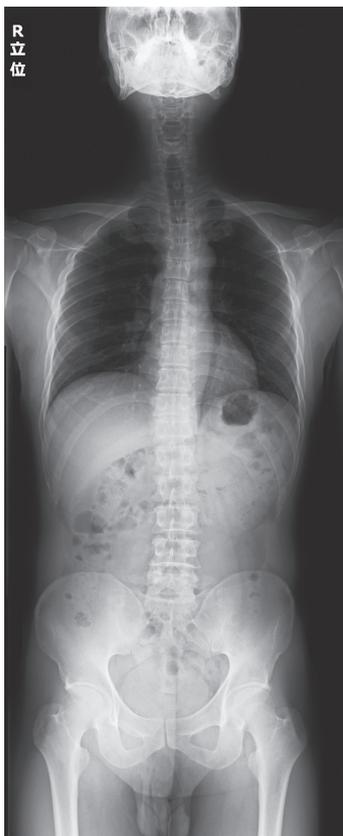


Fig.5

At first, our hospital acquired just 1 of these auto stitching systems, and we discussed what to do if the system failed during consultation hours. Taking into account the extreme difficulty involved in using the old system and safety and convenience for patients offered by the new system, we came to the conclusion to perform examinations at a later date. That we were so unwilling to go back to using the old system shows how much more efficient the new auto stitching system is in comparison. Fortunately, we have had no system failures since introduction of the first unit, and a second unit has since been acquired in February this year. Although positional misalignment occurs on rare occasions due to patient body movement, we have received no complaints from doctors about distortion or other image problems, and are continuing our transition to the auto stitching system.

4. Experiences Using Auto Positioning

For many years we have manipulated and positioned the X-ray tube manually, and the automatic positioning (auto positioning) used by the new system has made a significant difference. The efficiency of this system is based on displaying imaging orders sent from the ordering department on the DR console, and specifying X-ray tube positioning based on that information. Holding down the X-ray tube movement switch on the controller moves the X-ray tube to its prescribed position (**Fig. 6**). The patient can also be moved in place onto the stand while the X-ray tube is moved to the middle of the bucky unit. Changing from recumbent radiography to standing radiography was also particularly easy. When deciding whether to use the



Fig.6 Auto Positioning

Table 2 Auto Positioning X-Ray Tube Movement Times (at Our Hospital)

Movement Distance (cm)	Movement Time (sec)
50	5.2
80	7.6
100	9
120	10.3
150	12.3

system for actual use, while controller speed and safety are assured, I personally feel the movement speed of the system is appropriate (**Table 2**). The movement switch is a dead man type, so the X-ray tube only moves while it is depressed, and if danger is observed the tube stops immediately once the switch is released. You must still be aware of your surroundings and never let the X-ray tube out of sight during movement, but if this is done, it is a safe and useful system. Of course, some technologists prefer to manually manipulate their equipment, but at

our hospital every technologist currently uses auto positioning. In the future, I expect auto positioning to become a mainstream feature of general radiography.

5. Summary

When viewed in this way, the above combination of general radiography system and FPD system is more than sufficient, and I suspect no other system provides this level of efficiency and cost-effectiveness for auto stitching radiography. When selecting equipment I prefer to have multiple options as competition, but in the present case the system was chosen unopposed since there were no other products with specifications to rival it. Recent announcements in auto stitching radiography include three-piece FPDs and single-piece large-format FPDs and I look forward to future developments in these areas, but at present and judging auto stitching radiography as a whole, our system seems to outperform all others. Finally, after using this system in actual clinical practice in the past year since it was acquired, the auto stitching radiography system and auto positioning feature have, in fact, played a substantial role in shortening patient waiting times for our hospital's radiography department. My hope is that more innovative products that offer even greater benefits for both patients and health-care professionals will emerge from Shimadzu in the future.