

## Low Dose Mode of SUREngine FAST Highly Rated for Use in Biliopancreatic Endoscopy



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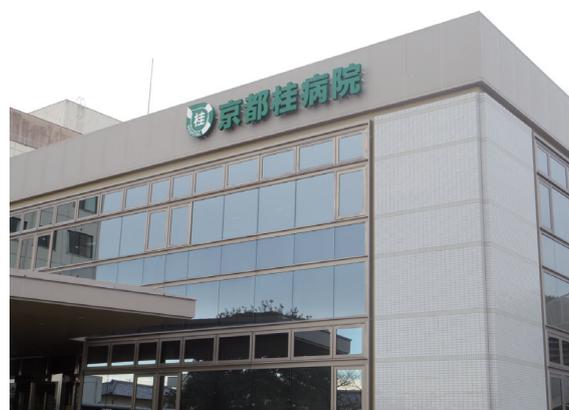


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### ■ Biliopancreatic Endoscopy at Kyoto Katsura Hospital

Our SONIALVISION G4 system ("G4" below) has been used for 600 examinations per year, including colon examinations. Almost 400 of those cases involved examining the pancreaticobiliary system, mostly for endoscopic retrograde cholangiopancreatography (ERCP).

The role of the radiological technologist during pancreaticobiliary examinations is to manage the system and control image quality, of course, but it is also especially important to work in a closely coordinated manner with the assigned physician during examination. Therefore, a radiologic technologist is always assigned to all ERCP procedures. We have three appointed radiological technologists available, except on holidays, at night, or for emergency examinations or procedures.



### ■ Improvements in Pancreaticobiliary Endoscopic Examinations after Introducing the G4

Whenever the assigned physician changes or the system is replaced, the radiological technologist confers with the physician in advance to decide image sizes, left-right inversion, negative/positive display modes, and other details. Currently, we use a 12-inch field-of-view size for ERCP procedures, with fluoroscopy images in AP mode and positive-display mode, with radiography images in the negative-display mode. Settings for ERCP and other examinations are managed by using the G4's Procedure function, which can specify all program settings at once for each examination and also automatically configure X-ray parameters. Even if an appointed technologist is not available, initial settings can be configured by selecting the Procedure. During ERCP procedures, typically, patients are positioned head down on the tabletop, so the AP image is displayed so that the physician does not feel discomfort when the eyes are moved from the endoscopic image to fluoroscopic images.

We think the position of the monitor is especially important for ERCP procedures. When the G4 was installed, the position of monitor in the examination room was arranged so that the fluoroscopic image could be seen immediately with minimum movement of the eye line from the endoscope image.

We also have introduced the picture-in-picture function for recording video images. During ERCP procedures, fluoroscopic images are output from the G4 system and



saved together with the endoscopic image as a picture-in-picture video image on the computer. Previously, endoscopic and fluoroscopic images were saved separately, which involved an extremely tedious and time-consuming process, but now that we can record video with both modalities synchronized it is much more convenient. The video can be replayed immediately, so physicians can watch the video to review the procedure after examination. For example, they can learn from watching how veteran physicians do examinations differently, such as how they operate the endoscope during cannulation.

**Measures to Reduce X-Ray Dose at our Hospital**

At Kyoto Katsura Hospital, I think the level of awareness about protecting medical personnel from radiation exposure is relatively high. Medical personnel wear not only a full protective cover that also covers the back, but they also wear a neck guard and protective eyewear. X-ray dose levels are measured using a glass dosimeter monitor worn on the chest (or abdomen) and a glass dosimeter for the eye lens worn on the head (or neck). Nursing personnel also wear the same protective gear. Also, due to requests from physicians and others, a protective cover was installed over the main unit to protect personnel from exposure to scattered X-rays emitted from the X-ray tube.

The fluoroscopy image processing engine in the G4 system currently used for ERCP includes functionality for reducing X-ray dose from fluoroscopy, of which we mainly use the (1) normal dose, (2) L2 (low-dose 2), and (3) L3 (low-dose 3) modes. A pulse rate of 15 frames is used for all three modes, but a 7.5 frame fluoroscopy mode is also available. (See Fig 1.)

If an appointed technologist is assigned, fluoroscopy is started in the L3 mode and then switched to L2 if visibility in fluoroscopic images is inadequate, due to the patient body characteristics or other factors. We are also mindful of operating the collimator properly to avoid irradiating unnecessary areas with X-rays. The virtual collimator is especially helpful for that purpose. The ability to display the collimation status in the last hold fluoroscopic image ensures radiation is collimated to the optimal position when fluoroscopy is started.

Just before examinations, we have a briefing from the physician about the patient’s symptoms and the examination or procedures to be performed. That helps to anticipate how the examination or other procedures will be conducted to better determine the timing of fluoroscopy or radiography.

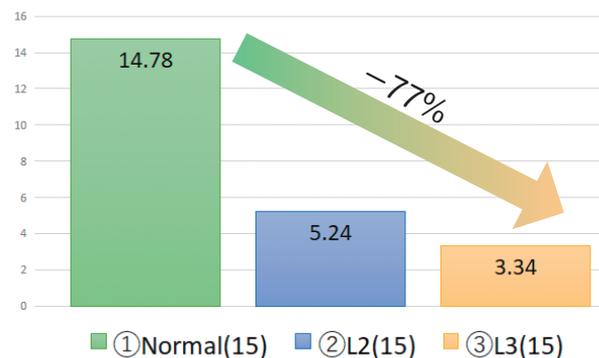


Fig. 1 Dose Level for Each Fluoroscopy Mode (AKR in mGy/min)

In general, fluoroscopy is performed at the timing specified by the physician. Because technologists remain in the control room waiting for the physician’s instructions, the timing tends to be delayed. Therefore, technologists try to act as though they are also present in the examination room. Because the technologists perform their job full-time, they eventually can anticipate the procedure habits of the physicians. For example, they can generally anticipate the timing for switching fluoroscopy ON or OFF without being told. During examination, technologists watch three things—the fluoroscopy image, the endoscopy image, and where the physician is looking. That makes it easy to imagine the timing for switching fluoroscopy ON/OFF based on the progress status in the endoscopy image and enables fluoroscopy to be switched OFF when the physician looks away from the fluoroscopy monitor. This type of coordinated operating style allows the physician to concentrate on the procedure and helps reduce any unnecessary fluoroscopy exposure. It is in these types of situations where having appointed technologists is especially beneficial.

For the reference, this is the data that shows a comparison of total exposure dose levels for actual procedures in the L2 and L3 modes.

<Table> Total Exposure Dose Comparison for Examinations in L2 and L3 Modes

	Pulse Rate	Fluoroscopy Parameters		Accumulated Fluoroscopy Time	Number of Exposures	Dose Area Product	Total Exposure Dose*
		Tube Voltage	Tube Current				
L2	15fps	93kV	4.2mA	10minute 10seconds	16images	323.7 $\mu$ Gym <sup>2</sup>	65.9mGy
L3	15fps	91kV	2.7mA	10minute 8seconds	16images	225.7 $\mu$ Gym <sup>2</sup>	58.0mGy

\* Total exposure dose was measured in terms of the air kerma rate at a point 30 cm above the tabletop, in accordance with IEC regulations.

### ■ Key Considerations during Examination

When fluoroscopy is performed in the beginning of examination, the angle and position of the fluoroscopy view is decided based on the predicted path of the target duct (biliary or pancreatic duct). Then at the stage the guide wire is inserted, fine adjustments are made to ensure both the wire tip and end of the endoscope camera are visible within the field of view. If insertion is difficult using the default 12-inch field of view, the technologist can suggest magnifying the view by switching to the 6-inch view and then switching back to the 12-inch view after insertion. If the scope of the endoscope overlaps with the region of interest, then X-rays can be projected at an oblique angle to ensure the region of interest can be properly observed.

### ■ Evaluation of the L3 Ultra-Low Dose Mode in SUREngine FAST

My first impression was “Wow, this is amazing!”

Even though the new low-dose mode (L3) reduces dose level about 35 % lower than the previous low-dose mode (L2), it results in almost no noticeable degradation of image quality. Contrast and graininess can be slightly worse for large patients, but I did not notice any appreciable decrease in guide wire visibility or contrast with respect to contrast agent, for example. The L3 mode may have some minor issues that need ironing out, but it is more than adequate for regular ERCP use. Given that it can decrease exposure dose levels by 75 % compared to the normal mode, I think it is very effective.



### Advice to Physicians Considering a SONIALVISION G4 System

Since dose management is the job of the technologist, we think that it is very important to provide the best possible conditions for medical personnel and patients. We think the SUREngine FAST functionality for low-dose fluoroscopy deserves high marks for its ability to reduce exposure dose levels while maintaining a high level of image quality. Furthermore, the SONIALVISION G4 also offers very high performance levels.