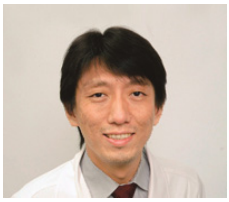
R/F

The Importance of Fluoroscopic and Radiographic Images in Endoscopic Examinations

Hiroshima University Hospital, Department of Gastroenterology and Metabolism



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Hiroshima University Hospital (Hiroshima City, Hiroshima Prefecture) is a general hospital that provides advanced medical treatment and contains 740 beds (700 medical, 40 dental). Its Department of Gastroenterology and Metabolism undertakes a wide range of clinical and research activities concerning gastroenterological and pancreaticobiliary diseases. Since September 2013, the department has used a SONIALVISION G4 (hereafter "G4") as an R/F system specifically for gastroenterological endoscopy examinations, and rates the G4 very highly with respect to ERCP and PTBD endoscopic procedures in particular. For this article, we asked Dr. Masahiro Serikawa what features are needed in an R/F system when performing endoscopic examinations, and what they have done to create an examination environment amenable to their needs.

—Your department specializes in endoscopic examination and treatment. Please briefly describe your department and its distinguishing features.

Our pancreas research laboratory carries out a wide range of clinical and research activities concerning pancreaticobiliary diseases. Of such diseases, pancreatic cancer and bile duct cancer are difficult to diagnose at an early stage, and have a poor prognosis amongst all cancers. Generally, pancreatic cancer is diagnosed using ERCP or EUS, but at our research laboratory, in addition to these techniques we diagnose pancreatic cancer at an earlier stage by measuring telomerase activity in cells found in pancreatic fluid. We also aim to provide treatment that is more tailor-made to the patient by evaluating for the degree of malignancy based on materials such as biopsy specimens, and selecting the treatment method in consideration of patient QOL (Quality of Life). The number of patients with pancreaticobiliary diseases seen at our research laboratory has increased rapidly in recent years, and developing doctors with a diverse range of examination and treatment experiences is essential. We expect the number of such doctors to increase in the future.

—Please give details of the main examinations and procedures the G4 is used for, with numbers for each.

We use the G4 for a broad range of diseases ranging from malignant diseases such as pancreatic cancer and biliary cancer, to benign diseases such as acute/chronic pancreatitis, autoimmune pancreatitis, sclerosing cholangitis, choledocholithiasis, and benign biliary stricture. We are also active in developing specialists that are capable of handling a wide variety of pancreaticobiliary diseases. We have a policy of making younger doctors perform examinations and treatments that creates an excellent environment for education in clinical techniques.

The number of examinations and procedures performed each year is 1000 ERCP-related procedures (of which 90 are IDUS), 450 EUS (of which 50 are EUS-FNA), and 500 PTBD-related procedures (of which 80 are first punctures). We also perform other procedures including peroral pancreatoscopy (POPS), peroral cholangioscopy (POCS), endoscopic naso-gallbladder drainage (EDGBD), endoscopic papillectomy (EP), double balloon ERCP (DBERCP), endoscopic gastrointestinal stent treatment, endoscopic pancreatic stone treatment, and extracorporeal shock wave lithotripsy (ESWL).

(Note) EUS: Endoscopic ultrasonography
IDUS: Intraductal ultrasonography
PTBD: Percutaneous transhepatic biliary drainage

—Please tell us what qualities are required in an R/F system for endoscopic examinations, and your evaluation of the G4.

Clearly visible fluoroscopic images and high-resolution radiographic images that are captured quickly

Visibility of wires and devices is important for fluoroscopic images. Specifically, a balance of minimal blurring caused by the subject movement, high resolution, minimal noise, and good contrast so small objects are easily visible, is important. All these qualities are not usually obtainable simultaneously, so prioritizing one leads to deterioration of another, such as higher resolution resulting in slower responses. However, the locations we observe are not moved, so for observations of the pancreas and bile duct we do not really need a fast response. For us, more important than fast responses is high resolution and being able to observe small objects. Also, how the end of the catheter is visualized is very important.

As for diagnostic ERCP, since around 10 years ago there has been a trend for dropping the use of ERCP due to the spread of EUS-guided needle biopsy, but with recent developments the importance of diagnostic ERCP is being reassessed for detecting lesions as early as possible. This requires visualization of how the contrast medium flows through each individual pancreaticobiliary duct while it is being added little by little, as opposed to adding a large quantity of contrast medium from the start. The G4 provides us with enough resolution to be able to view each individual duct **(Fig. 1)**.

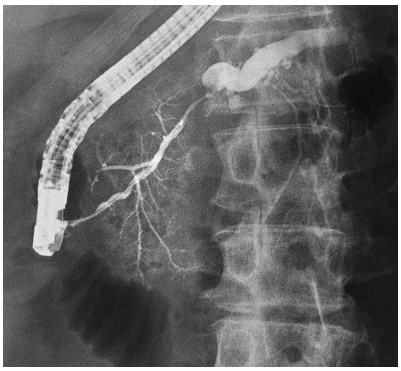

Fig. 1

Furthermore, the substantial improvement in image visibility has shortened the time it takes to complete a day of examinations. This may partly be due to our efficient use of the G4 system, but since the number of examinations has not changed over time the reduction in time required must be due to each individual examination taking less time. The time it takes to perform a day of examinations has been reduced by five hours, which is a direct result of improved fluoroscopic performance reducing the duration of each individual examination.

As for radiography, changing from the previous system to Shimadzu's G4 has resulted in a definite increase in speed when changing from fluoroscopy to radiography. It is very easy to switch from fluoroscopy to radiography because it is fast enough that the patient does not need to hold their breath. Images can be obtained as soon as we press the exposure switch (less than 1 second from fluoroscopy to radiography) so there is almost no blurring and the patient need not be instructed to hold their breath. We use these images to evaluate lesions after the examination and for use in presentations in seminars or study meetings. Early diagnosis of pancreatic cancer, a recent topic of research, requires clear images that show individual bile duct branches, and we are satisfied with the quality of the fluoroscopic and radiographic images produced by the G4 in this respect.

An R/F table that provides space and is stable

Workspace requirements for procedures call for the ability to approach the patient from the periphery of the tabletop, and the G4 allows us this access without obstruction. All the staff in our department that have used R/F systems in other hospitals comment in how easy the G4 is to use in comparison. The G4 also provides enough space for the nurse to approach the patient from the back and tend to their head.

Endoscopy sometimes requires the use of a C-arm R/F system. Since endoscopic examinations of bile ducts require an understanding of spatial structure, a C-arm R/F system, where the C-arm can be tilted to approach the patient from many angles, is desirable. Nevertheless, island-type systems can also be used by tilting the angle of the patient. Furthermore, C-arm R/F systems have a narrow tabletop that leads to problems with system and patient stability. Many hospitals use an island-type R/F system with a wide tabletop that gives system and patient stability in anticipation of patient movement during the procedure. Because the G4 system is robust (load capacity: 200 kg), it is very stable and poses no concerns in terms of system and patient stability **(Fig. 2)**.

We also use the convenient bedside controller on the G4 **(Fig. 3)**. Due to space constraints we do not use a local control console, instead the bedside controller is used to raise and lower the tabletop while the operator remains close to the patient, which is a real convenience.

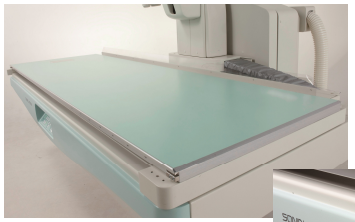

Fig. 2

Fig. 3

—Please explain in what other ways you have improved endoscopic examinations in your department.

(1) Combining fluoroscopic and endoscopic images and their video recording

In our department, we display fluoroscopic and endoscopic images on the same screen and record video from the screen **(Fig. 4)**. When the fluoroscopic and endoscopic images are recorded separately there is no link between the two sets of images, which makes editing them difficult. After an examination, though you may find where a lesion is on the endoscopic image you do not know where it is on the fluoroscopic image, so to avoid this problem the fluoroscopic and endoscopic image streams must be recorded on the same timeline. Video has become the mainstream in our field of medicine in recent years, with the positional relationship between fluoroscopic and endoscopic images being of particular importance. While video recording allows for use in academic presentations and education, its most important application is examination reviews. Anyone can make an objective judgment on CT and still images, for example. In examinations that continue for some period of time, on the other hand, it is difficult to make a correct evaluation based on still images, and reviewing requires video streams that have been recorded simultaneously.

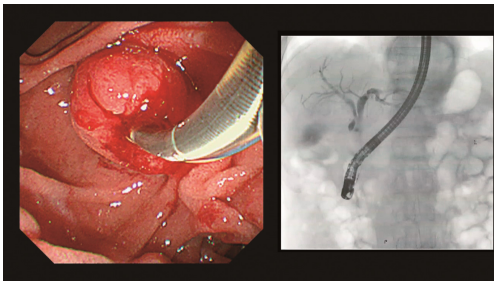

Fig. 4

(2) Additional monitors to display endoscopic and fluoroscopic images

We have installed more monitors to display fluoroscopic and endoscopic images to provide a better examination environment **(Figs. 5 and 6)**. These monitors allow us to confirm the lesion location based on fluoroscopic images while also viewing ultrasound images, and to also observe these images from a number of different locations in the room **(Fig. 7)**. If an operator must assume an uncomfortable position during a procedure to be able to view images it can affect the procedure, and different operators have different requirements in terms of which angles they prefer to view monitor images, so having more monitors is naturally more convenient. Furthermore, during PTBD the patient's head and feet are switched compared to endoscopy examinations, and this change is easily accommodated by using movable suspended monitors.

(3) Reducing operator exposure levels

We use pulsed fluoroscopy to reduce radiation exposure during examinations, but to further reduce radiation exposure we have installed a protective curtain. Thanks to the protective curtain radiation exposure is no longer a concern. Installing the curtain is not that difficult, and is very valuable. In the future, we intend to determine the effect of the protective curtain in numeric terms.

Fig. 5 Endoscopy examination

Fig. 6 Examination room

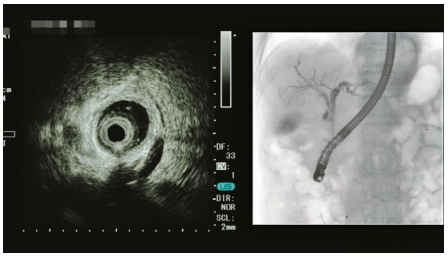

Fig. 7

—Please tell us the advantages of the G4 system you would like to emphasize, for facilities currently considering introducing a new R/F system or replacing an existing system.

Though I am repeating myself, the most important point is the clarity of the images, as I mentioned at the start. Another point of emphasis is the quick switching from fluoroscopy to radiography. These are the advantages of the G4 system we would like to emphasize.

—Thank you very much.