

The Imaging Technology of Gastrointestinal X-ray Examination through Field surveys

Tsutsumi

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INTRODUCTION

Exposure dose of the patient in the gastrointestinal X-ray examination is the total of the exposure by the fluoroscopic dose and the exposure by the radiographic dose.

This report discusses the change in the radiographic technology of the gastrointestinal X-ray examination and the estimated value of the patient entrance surface dose calculated from the survey data in 1990.

We have carried out the field surveys to investigate the Japanese radiographic technology in 1980, 1985, 1990 and 1995.

A medical exposure was taken up on 1990 Recommendations of the International Commission on Radiological Protection. And then IAEA amended International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). In the BSS, guidance level was introduced to limit the improper medical exposure. The guidance level for the gastrointestinal X-ray examination, however, hasn't been shown yet.

In Japan, an upper gastrointestinal X-ray examination is being carried out as well for the mass screening to target healthy adults. Therefore, a patient's exposure should be managed properly. On the other hand, the image quality of the gastrointestinal radiography which should be necessary for a doctor to make a diagnosis hasn't been decided yet. The decision of the necessary image quality is indispensable on the occasion of the switchover to the digital system from the analog system. A patient's exposure reduction is closely related with the image quality of the radiography.

METHOD

The response rates of the field surveys conducted four times are shown in Table 1.

Table 1 The response rates of the Field surveys conducted four times.

year	response hospitals	response rates
1980	221	63%
1985	309	59%
1990	351	66%
1995	267	43%

The survey responses has been mainly from big institutes. Through 4 times surveys, the standard thickness of the patient's abdominal has been set as 18cm to collect the standardized radiographic conditions.

NDD method determined by Mr. Mori et al was used to calculate the estimated dose. Accuracy of the NDD method was ascertained by the experiments used with a skin dose monitor and an ion chamber. Though there were unclear responses toward the question about the total filtration of the X-ray tube in some cases, the response was estimated by the present conditions of the X-ray TV device in the Japanese market. And the estimated value of the patient entrance surface dose was calculated in the case of an institute responded to all the items in the survey.

RESULTS

There are an under table tube type and an over table tube type of X-ray TV, and the latter is most at present. As for the figure which showed it in Fig. 1, less than 99cm in the focal spot-film distance is under table tube type. It is in the tendency of the decrease. Fig. 2 shows that the tendency of the radiographic voltage is becoming little higher.

Fig. 3 shows the kind of high potential generators. There are few devices of 2peak with being natural. Fig. 4 shows the tendency of the radiographic current. Fig. 5 shows the exposure time. But the exposure time can be shorter because of the capacity of the X-ray tube being used.

Fig. 6 is the distribution of the focus spot sizes of the X-ray tubes. The smaller focal spot size can improve the image quality without any relationship of the exposure dose.

A gap of the calculated dose among the institutes was bigger than expectation. It is thought due to the poor quality control of the X-ray output equipment and the image recording system.

DISCUSSION

- Because the value of the patient entrance surface dose wasn't actually measured, it might not represent the present situations in Japan. Also, due to one of the gastrointestinal X-ray imaging system selected from one institute in the field survey, the best system might be chosen. Therefore, the values in the under table tube type X-ray TV may be more than those shown in this report.
- A radiographic exposure voltage should be added in the item of the field survey because it is closely related with the concentration of the contrast media being used.
- At present, although the auto exposure control is commonly used, the operators should pay more attention to the image quality and the exposure dose.
- The radiographic technology of the gastrointestinal X-ray examination changes due to the technological innovation on the manufacturer's side.

CONCLUSION

- The calculated entrance surface dose is evaluated very useful to optimize the gastrointestinal imaging system.
- A gap of the calculated dose among the institutes is thought due to the poor quality control of the X-ray output equipment and the image recording system.
- A change in the radiographic technology of the gastrointestinal X-ray examination was put on record.

Fig. 1 shows the focal spot-film distance.

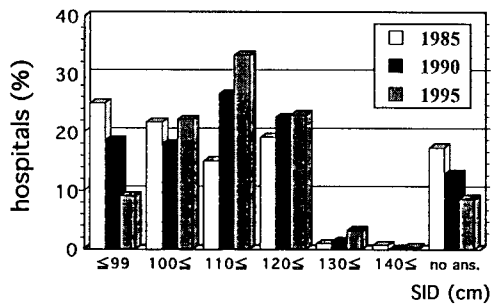


Fig. 2 shows that the tendency of the radiographic voltage.

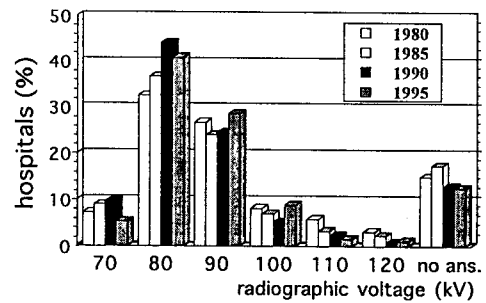


Fig. 3 shows the kind of high potential generators.

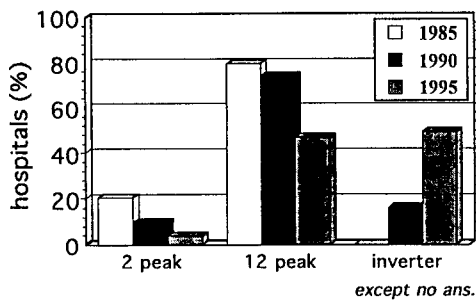


Fig. 4 shows the tendency of the radiographic current.

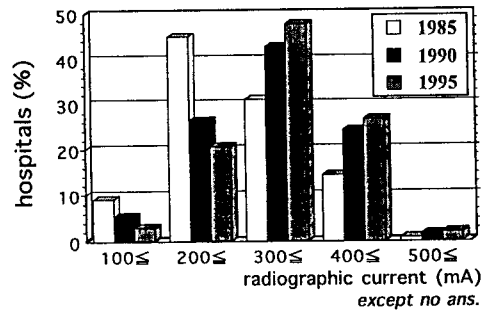


Fig. 5 shows the exposure time.

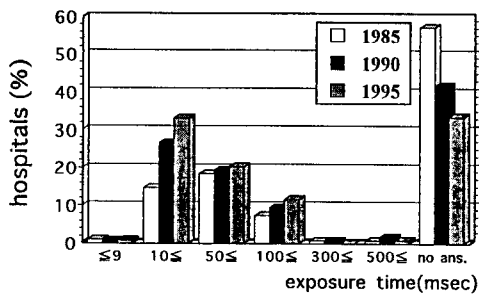


Fig. 6 is the distribution of the focus spot sizes of the X-ray tubes.

