

## Clinical Studies with 18F-5-Fluoro-Deoxyuridine in Lung Cancer

著者	Abe Y., Matsuzawa T., Itoh M., Fujiwara T., Yamaguchi K., Fukuda H., Sato T., Hatazawa J., Ishiwata K., Watanuki S., Ido T., Monma M.
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Abe Y., Matsuzawa T., Itoh M., Fujiwara T., Yamaguchi K., Fukuda H., Sato T., Hatazawa J., Ishiwata K.\*, Watanuki S.\*, Ido T.\* and Monma M.\*  
Department of Radiology and Nuclear Medicine, Research Institute for Tuberculosis and Cancer, Tohoku University  
Cyclotron and Radioisotope Center, Tohoku University\*

Fluorinated pyrimidines which inhibit nucleic acid metabolism were tried to apply cancer diagnosis.<sup>1,2)</sup> But their results were not sufficient because of misapplication for clinical use.

We studied three fluorinated pyrimidines,  $^{18}\text{F}$ -5-fluorouracil ( $^{18}\text{F}$ -5FU),  $^{18}\text{F}$ -5-fluorouridine ( $^{18}\text{F}$ FUR), and  $^{18}\text{F}$ -5-fluorodeoxyuridine in experimental animals, and concluded that  $^{18}\text{F}$ dUR was a suitable radiopharmaceutical for tumor imaging.<sup>3,5)</sup> Then, we began to examine tumor imaging study with positron emission tomography (PET).<sup>4)</sup> In this paper, we described the efficacy of  $^{18}\text{F}$ dUR for cancer detection clinically.<sup>4)</sup>

Materials and Methods

Radiopharmaceuticals

The synthesis of  $^{18}\text{F}$ -labeled fluorinated pyrimidines was described elsewhere.<sup>6)</sup> Chemical purity was more than 99% and specific activity was 2.8-3.3 mCi/mg at the time of injection. Quality assurance tests of  $^{18}\text{F}$ dUR for clinical use were performed according to the safety guidelines of the clinical research committee of our university.

Clinical study

A normal volunteer and four lung cancer patients, two with squamous cell carcinoma and two with small cell carcinoma. The study was approved by the clinical research committee of our institute and informed consent was obtained from all subjects. ECAT II was used for PET study. After transmission scans were performed using a  $^{68}\text{Ge}$  ring source  $^{18}\text{F}$ dUR (5-7 mCi) was injected IV as a bolus. Immediately after injection, continuous sequential scans were made at the fixed level. Each scan lasted 5 min. In a normal volunteer, rectilinear scan was done 90 min after injection.

Results

Clinical Study

Fig. 1 shows the tissue distribution of  $^{18}\text{F}$ dUR in a normal volunteer. Most of radioactivity was seen in the liver and kidneys, and was excreted to the urine.

Fig. 2 shows the image of  $^{18}\text{F}$ dUR in a lung cancer patient. In the first image, high radioactivity was seen in the tumor and great vessels en bloc, then, in the second image, the tumor was visible. Radioactivity of the tumor, however, was declining with time.

Table 1 is the tumor-to-lung and -soft tissue ratio of  $^{18}\text{F}$ dUR at 30 min after injection in four cases. First three tumors were clearly visible and easily distinguished from the surrounding tissues. But the last tumor was not clearly visible and its uptake was almost equivalent to that of the soft tissues.

#### Discussion

Clinical study with normal volunteer also reveal high radioactivity in the liver and kidneys. Since it is difficult to detect the cancer located on the abdomen with PET like animal study, we began to examine the lung cancer. We studied four lung cancer patients, three of four cancers were positively imaged and one of four was scarcely imaged. Tumor uptake varies from one patient to the other.  $^{18}\text{F}$ -2-fluoro-2-deoxy-D-glucose ( $^{18}\text{F}$ FDG) and  $^{11}\text{C}$ -methionine which are other positron labeled tumor tracing agents indicate the glucose and amino acid metabolism of the tumor, respectively. Since  $^{18}\text{F}$ dUR was incorporated into nucleic acid metabolism of the tumor<sup>5)</sup>, the tumor uptake of this radiopharmaceutical is different from that of  $^{18}\text{F}$ FDG and  $^{11}\text{C}$ -methionine.  $^{18}\text{F}$ dUR may indicate the nucleic acid metabolism of the tumor. But the quantitative analysis relating the rates of incorporation to the nucleic acids is not yet done. We are considering what types of tumor take  $^{18}\text{F}$ dUR much or less and are studying the relationship between the tumor uptake of  $^{18}\text{F}$ dUR and the tumor proliferation.

#### References

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Table 1.

TUMOR-TO-ORGAN RATIO OF  $^{18}\text{F}$ UR AT 30 MIN.

Case	Ratio	
	soft tissue	lung
small cell carcinoma	3.01	13.25
squamous cell carcinoma	2.14	8.71
small cell carcinoma	1.95	4.82
squamous cell carcinoma	1.15	4.94

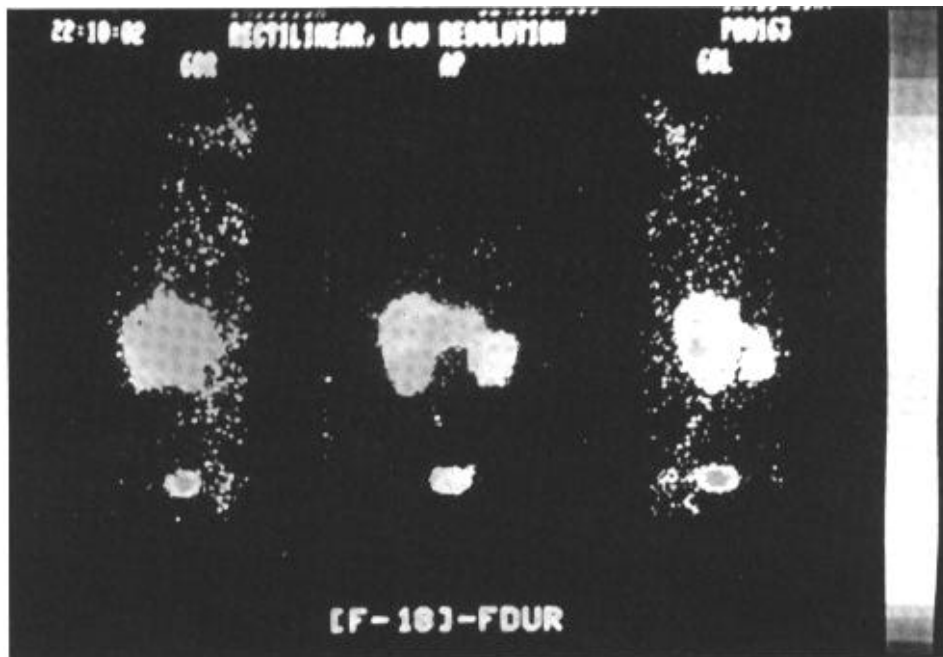


Fig. 1. Rectilinear scan of normal volunteer 90 min after injection of  $^{18}\text{F}$ FDUR.

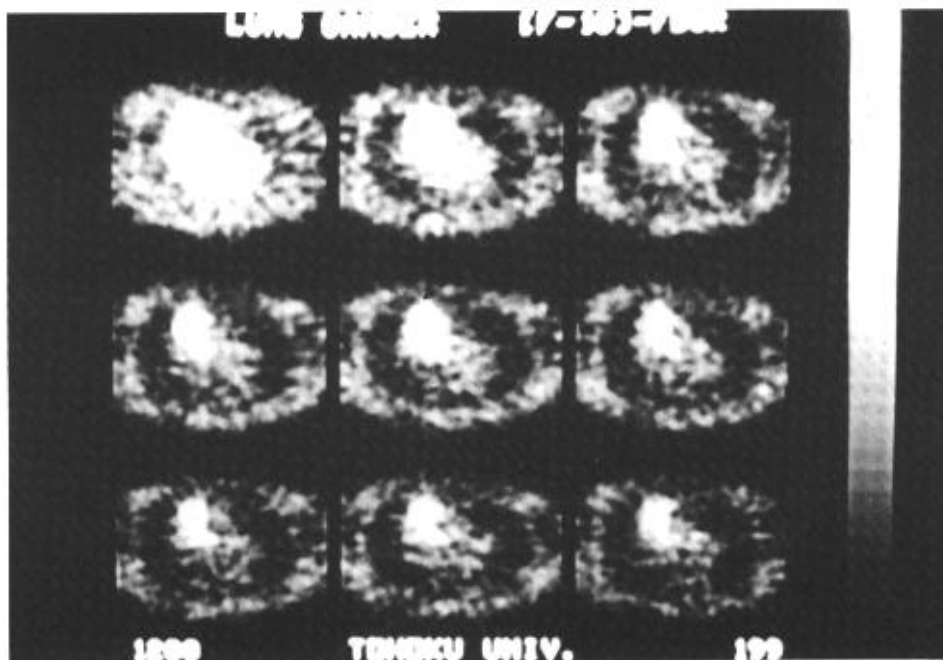


Fig. 2. Emission scan of lung cancer. Each scan lasted 5 min.