

## Symposium III.

### Diagnosis of Malignant Tumors with Radioisotopes

#### On the accumulation of rare earth elements in tumor

T. HIGASI, M. KANNO Y. NAKAYAMA and T. FUJIMURA

*Kanagawa Dental College, Yokohama*

K. TOMURA

*Institute for Atomic Energy of Rikkyo University*

K. NAKAMURA, A. MURATA and H. KATO

*Yokohama, Keiyu Hospital*

In numerous reports it has been shown that  $^{67}\text{Ga}$ -citrate is taken up in a variety of human cancer. Since then, many investigators have tried to find a better tumor-specific Scanning agent than  $^{67}\text{Ga}$ -citrate for the diagnosis of malignant tumors. However, as yet, success has been limited.

Recently, radioactive rare earth elements such as  $^{169}\text{Yb}$ ,  $^{153}\text{Sm}$  and  $^{157}\text{Dy}$  have been introduced to nuclear medicine. The present communication reports the comparison of the accumulation of rare earth elements of lanthanons such as  $^{140}\text{La}$ ,  $^{141}\text{Ce}$ ,  $^{147}\text{Nd}$ ,  $^{152}\text{Eu}$  and  $^{177}\text{Lu}$  with the accumulation of  $^{67}\text{Ga}$  in the Ehrlich's tumors and other organs in tumorbearing mice. In addition, we have reported uptake of Ytterbium 169, an isotope of one of the rare earth elements, in tumors implanted in rats as well as in malignant human tumors. The radioactive rare earth elements were products of the Institute for Atomic Energy of Rikkyo University. Standard solution was produced by mixing about  $3\text{ }\mu\text{Ci}$  of each of the 7 radionuclids such as  $^{67}\text{Ga}$ ,  $^{140}\text{La}$ ,  $^{141}\text{Ce}$ ,  $^{147}\text{Nd}$ ,  $^{152}\text{Eu}$ ,  $^{160}\text{Tb}$  and  $^{177}\text{Lu}$ . About  $0.2\text{ cc}$  of standard solution was injected into the abdominal cavity of each tumor-bearing mouse. Three mice were sacrificed at 28 hours and 48 hours after injection. The tumor, liver, spleen, kidney and bone were analyzed. The photo-peaks of these radionuclids in each organ were measured with a 4000-channel multianalyzer attached to a Ge (Li) semiconductor detector.

Furthermore, we have studied the accumula-

tion of  $^{169}\text{Yb}$ -citrate, is a rare earth element, in various organs of the rats bearing Yosida tumor with scintiscanner. Scinticamera images of seven patients with cancer of the lung, stomach and intestine were obtained at forty-eight hours after injection of  $500\text{ }\mu\text{Ci}$  of ---Yb-citrate.

#### Results

The accumulation of rare earth elements in tumor at 48 hours after administration was somewhat higher than that of  $^{67}\text{Ga}$  except in the case of  $^{140}\text{La}$ . The accumulation of rare earth elements in liver and kidney was lower than that of  $^{67}\text{Ga}$  except in the case of  $^{152}\text{Eu}$ . It is interesting to note that these rare earth elements are different in uptake despite their similar position on the periodic law table.

In vivo visualization of  $^{169}\text{Yb}$  in rats bearing Yosida tumor at five days postinjection in peritoneal cavity revealed the evident accumulation in bone and tumor. While the that of liver and other organs is poor. This results revealed significant differences between that of  $^{67}\text{Ga}$ -citrate. Ytterbium, like other lanthanons, is largely accumulated in the bones.

Clinically, an accumulation of  $^{169}\text{Yb}$  in human malignant tumor showed a remarkable decrease compared with the  $^{67}\text{Ga}$  uptake. However, this preliminary data from an animal experiment and malignant human tumor suggest the possibility of clinical usefulness of a good tumor-seeking radiopharmaceutical agent.