

F. Tumor Diagnosis in General

Cyclotron Production of ^{197m}Hg and Its Use for Lung Tumore Imaging

T. KARASAWA

Institute of Physical and Chemical Research, Tokyo

T. HARA, M. IIO and T. HIRATA

National Nakano Chest Hospital, Tokyo

$^{197}\text{HgCl}_3$ has been used in the hospital identification of lung tumors by external scintillation imaging, though not as commonly as ^{67}Ga . Scintillation scanning in our hospital obtained a 90% positive uptake with ^{197}Hg in primary lung tumors (130 cases). The use of reactor-made ^{197}Hg , however, includes a possibility of mercury poisoning. Moreover, the 77 keV γ -ray of ^{197}Hg and associated K X-ray from the daughter ^{197}Au are readily absorbed and scattered by tissues in the neighborhood of a hot area, resulting in failure of clear resolution in the scintiphoto.

Cyclotron production of ^{197}Hg was thus initiated and has overcome these difficulties. At present, scintillation scanning with ^{197m}Hg has

been made about 30 cases.

^{197m}Hg was produced in the IPCR 60" cyclotron by the reaction of $^{197}\text{Au}(d,2n)^{197m}\text{Hg}$. The excitation curve up to 23 MeV are presented. Chemical process of extraction Hg from Au is reported elsewhere.

Chest scanning were performed in lung tumor patient focussing on 134 γ -ray at 24 hours after i.v. injection and visualized well localized hot areas of lung tumor.

In summary, ^{197m}Hg was produced by a cyclotron and isolated carrier-free form. The usefulness of this new radiopharmaceutical for the lung tumor imaging was confirmed in the clinical examination.

On the Accumulation of Rare Earth Elements in Tumor and its Mechanism.

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

Kanagawa Dental College, Yokosuka

K. TOMURA

Rikkyo University Atomic Institute, Yokosuka

It is known that the accumulation of ^{67}Ga -citrate is much higher in cancerous tissue than in normal tissue. However, the actual mechanism of uptake of ^{67}Ga -citrate in the tumor cells is still unknown. The purpose of this paper is to

report our experimental results on the mechanism of uptake of ^{67}Ga in Ehrlich's tumor cell by comparing the accumulation of rare earth elements with the accumulation of ^{67}Ga -citrate.

Radioisotopes used in our experiments are 10

kinds of trivalent metals such as ^{67}Ga , ^{46}Sc , ^{177}Lu , ^{169}Yb , ^{166}Ho , ^{160}Tb , ^{153}Gd , ^{152}Eu , ^{153}Sm , ^{140}La . This radioisotopes was injected in tumor-bearing mice. The mice were sacrificed 48 hrs after injection. The tumor, liver, bone, spleen, kidney, pancreas and thymus were analyzed. The gamma-ray spectra of these radionuclids in each organ were simultaneously measured by Ge(Li) semiconductor detector.

- (1) There seems to be a relationship between the accumulation of trivalent metals in biological organs and ionic radius. It has been classified into 3 types as follows: diminishing, parallel and increasing types.
- (2) To explain a larger accumulation of Gallium

than of other trivalent elements in the tumor cell, we would like to postulate that Gallium might pass through the tumor cell membrane much more easily than the other elements because the ionic radius of gallium (0.62 \AA) is similar to that of magnesium (0.66 \AA) which plays an important role in the transport process. However, we think that the calcium element plays less important role in the transport.

- (3) The accumulation of Eu in biological organs revealed a high anomaly in all organs with the exception of the liver. A similar tendency was seen in the earth and lunar rock samples.

The Mechanism of Uptake of ^{169}Yb in Tumor

—in compounds with ^{67}Ga and ^{111}In —

A. ANDO and T. HIRAKI

School of Paramedicine, Kanazawa University, Kanazawa

K. HISADA

Department of Nuclear Medicine, School of Medicine, Kanazawa University, Kanazawa

As the tumor affinity agents are well known such as ^{67}Ga -citrate, ^{111}In -citrate, ^{169}Yb -citrate, ^{203}Hg -chlormerodrin, ^{203}Hg -glutathione, ^{208}Bi -acetate, ^{131}I -human fibrinogen and ^{57}Co -bleomycin. The mechanism of isotope localization within the tumor is not known, but some compounds of group III (Ga, In, Yb) and peroidic VI (Hg, Bi) in the periodic table is suggested that the affinity mechanism is caused with biological behavior of individual elements. At this time, it is known that some tumor affinity compounds of group VI were superior to these of group III in binding capacity to the protein by our experiments. In the results of our own experiments, it

was considerable that affinity mechanism of elements in group III differed from periodic VI.

The difference of their in vivo distribution between ^{169}Yb , ^{67}Ga and ^{111}In was investigated in order to know exactly the property by using Yoshida sarcoma bearing rats. In this investigation, there was no remarkable difference of the uptake in tumor tissue between these elements. But large difference in the biological properties of these compounds was observed about the retention value in the blood and the uptake rate in the bone. ^{169}Yb was rapidly cleared from the blood and was taken mostly into the bone. So the retention values in the soft tissues became very small.