

## Comparative Study of $^{111}\text{In}$ -Bleomycin Accumulation with $^{67}\text{Ga}$ -Citrate and $^{111}\text{In}$ -Chloride

Yasuhiko ITO, Tsuneji ICHIKAWA, Akira MURANAKA,

Tsuneo YOKOBAYASHI and Yoshinari IMAJO

*Department of Nuclear Medicine and Radiation Therapy Kawasaki Medical School  
Kurashiki, Japan*

### ABSTRACT

Tumor affinity of  $^{111}\text{In}$ -bleomycin (BLM) was investigated with VX-2 rabbits and the patients with lung cancer.

As the basic approach for this study the following investigation were performed: 1) the clearance of BLM from blood was compared with that of  $^{111}\text{In-Cl}_3$ ; 2) the distribution of BLM in various organs of VX-2 rabbits two days after administration was compared with that of  $^{111}\text{In-Cl}_3$ ; 3) after simultaneous administration of BLM and  $^{67}\text{Ga}$  into VX-2 rabbits the distribution of these two substances in organs was studied 2 and 3 days later; 4) the comparison was made of  $^{67}\text{Ga}$  being contained in urine and feces; and 5) after injecting turpentine oil into the muscle the accumulation in the inflammatory site was compared with that of  $^{67}\text{Ga}$ .

By administering BLM and  $^{67}\text{Ga}$  to patients with cancer at the interval of about one week the ratio of radioactivity in the lesion to that in

the surrounding normal lung was estimated by setting ROI.

The clearance of BLM from blood required 14.5 hours while that of  $^{111}\text{In-Cl}_3$  took 12 hours. The ratio of BLM in tumor to tissue was about the same as that of  $^{111}\text{In-Cl}_3$  or slightly less. The ratio of tumor to muscle was BLM: 7.81, and  $^{111}\text{In-Cl}_3$ : 15.94. The clearance rate in tumor to blood was 2.68 with BLM and 3.58 with  $^{111}\text{In-Cl}_3$ .

As to the ratio of  $^{67}\text{Ga}$  both 2 days and 3 days after administration of BLM  $^{67}\text{Ga}$  showed a greater value in the tumor to tissue ratio. The tumor to muscle ratio was  $^{67}\text{Ga}$ : 50.57, BLM: 10.40 two days later while 3 days later it was  $^{67}\text{Ga}$ : 31.0 and BLM: 10.42. The excretion into urine and feces was less in  $^{67}\text{Ga}$ .

With clinical cases the radioactivity accumulation is higher in  $^{67}\text{Ga}$ .

From the above results the tumor affinity of BLM has been confirmed, but it seems not so high as to replace  $^{67}\text{Ga}$ .

### Comparison Between $^{67}\text{Ga}$ -Citrate and $^{111}\text{In}$ -BLM as the Tumor Scintigram

M. KUMANO\*, Y. HIRATA\*, K. NARABAYASHI\*, T. UCHIDA\*\*, T. KATSURA\*\*,  
Y. INOUE\*\* and S. NISHIYAMA\*\*

*\*Department of Radiology, Hyogo Cancer Hospital, \*\*Department of Radiology,  
Kobe University*

We examined tumor scintigrams using  $^{67}\text{Ga}$ -citrate and  $^{111}\text{In}$ -BLM in 34 patients diagnosed of malignancy, and compared them.

Method: Scinticamera images were obtained 48 and 72 hours after injection of 2 mCi ( $^{111}\text{In}$ -BLM) and 72 hours after injection of 2 mCi ( $^{67}\text{Ga}$ -citrate). Considering all cases the percentage of positive scintigrams had been 73% for  $^{67}\text{Ga}$  and 68% for  $^{111}\text{In}$ -BLM. There was not so large difference in ratio between them, however positive cases using  $^{111}\text{In}$ -BLM were all accumulated using

$^{67}\text{Ga}$ -citrate. Tumor scintigrams using  $^{67}\text{Ga}$ -citrate showed more clearly activity in almost all cases than examined by  $^{111}\text{In}$ -BLM. Extensively, only 3 cases (undifferentiated cancer of the neck of unknown primary origin and pulmonary cancer with pneumonia) took more clearly than  $^{67}\text{Ga}$ -citrate. Tumor scintigrams could be accumulated at the head and neck and inguinal lesion of the malignant lymphoma, but tumor images of  $^{111}\text{In}$ -BLM was not so clear as  $^{67}\text{Ga}$ -citrate, the pulmonary and hepatic lesion clearly accumulated by

$^{67}\text{Ga}$ -citrate could not be found by  $^{111}\text{In}$ -BLM. Normal  $^{111}\text{In}$ -BLM scintigram, bone marrow (thoracic, lumbal vertebrae, and the pelvis) were well visualized in 26 of 34 cases, and little activity concentrated in the heart in 11 of 34 cases.

$^{111}\text{In}$ -BLM scan was rather difficult to find out mediastinal lesion than  $^{67}\text{Ga}$ -citrate. It was very difficult to find out abdominal lesion by  $^{67}\text{Ga}$ -citrate, because  $^{67}\text{Ga}$ -citrate were excreted into alimentary tract. But also it may be very difficult

for  $^{111}\text{In}$ -BLM to find out abdominal lesion, because by  $^{67}\text{Ga}$ -citrate only 3 in 20 cases lumbal or pelvic lesion can be found, and only 3 in 20 cases renal lesion can be found.

Conclusion:

1.  $^{67}\text{Ga}$ -citrate was more sensitive in tumor than  $^{111}\text{In}$ -BLM.
2.  $^{67}\text{Ga}$ -citrate was valuable in detecting mediastinal lesion.

### **Tumor Scintigraphy: Comparison and Clinical Evaluation of $^{67}\text{Ga}$ -Citrate and $^{75}\text{Se}$ -Selenomethionine**

T. OSAWA, H. HAMADA, K. HIROSE, S. SAWADA, T. FUJII, M. YANO, T. SUGANO  
*Department of Radiology, Kenseibu-Hamamatsu Medical Center, Hamamatsu*

#### **Introduction**

In the tumor scintigraphy with  $^{67}\text{Ga}$ -citrate and  $^{75}\text{Se}$ -selenomethionine in cases with various kinds of tumor, very useful results were obtained clinically.

#### **Method**

$^{67}\text{Ga}$ -citrate scannings were performed 1–3 times for 1–4 days after an intravenous administration of 2 mCi, and  $^{75}\text{Se}$ -selenomethionine scannings several times during 10 minutes to 4 days after the administration of 100–250  $\mu\text{Ci}$ .

#### **Result**

Abnormal concentrations of  $^{67}\text{Ga}$ -citrate were noted in malignant tumors, inflammatory lesions and sarcoidosis, but no accumulation of  $^{67}\text{Ga}$ -citrate in benign tumors.

While non-epithelial malignancies such as malignant lymphoma, malignant thymoma, malignant melanoma and mycosis fungoides etc. and liver cell carcinoma were visualized as the hot areas on  $^{75}\text{Se}$ -selenomethionine scintigrams but  $^{75}\text{Se}$ -selenomethionine scanning were negative in inflammatory lesions, benign tumors and carcino-

mas except for liver cell carcinoma.

#### **Conclusion**

Because the half life of  $^{67}\text{Ga}$ -citrate is shorter than that of  $^{75}\text{Se}$ -selenomethionine, the administration of a large dose of  $^{67}\text{Ga}$ -citrate is possible, and the tumors were clearly outlined.

On the other hand,  $^{75}\text{Se}$ -selenomethionine was administered only a small dose of its long half life, so the contour of the lesions was not clearly demarcated occasionally.

The abnormal concentrations of  $^{67}\text{Ga}$ -citrate were noted not only in malignant tumors (both epithelial and non-epithelial), but also in inflammations, sarcoidosis and normal pulmonary hili.

Therefore, the differentiation of natures of the malignant changes was almost impossible.

While  $^{75}\text{Se}$ -selenomethionine was concentrated only in hepatocellular carcinoma and non-epithelial malignant tumors. These results suggest that the abnormal accumulation of  $^{75}\text{Se}$ -selenomethionine may be considered as a sign of existence of non-epithelial malignancies except for liver cell carcinoma and its metastasis.