Double-Tracer Tissue Distribution Study of 18F-FDG and 67Ga Citrate in Inflammatory Lesion

III. 7. Double-Tracer Tissue Distribution Study of ^{18}F-FDG and ^{67}Ga Citrate in Inflammatory Lesion.

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Introduction

[^{18}F] 2-Fluoro-2-deoxy-D-glucose (^{18}F-FDG) positron emission tomography (PET) has been to be inadequate to evaluate inflammatory lesion[1], but lately, cases of high accumulation of ^{18}F-FDG in abscess have been reported[2-3]. In this study, we compared the biodistribution of ^{18}F-FDG and ^{67}Ga citrate in the experimental inflammatory lesion by double-tracer tissue distribution study.

Materials and Methods

Male Donryu rats weighing from 80 to 100 g were used. To produce experimental inflammatory tissue, the rats in 5 groups, each containing 5 rats, were subcutaneously inoculated with 0.2 ml of turpentine oil in their left groin and with 0.2 ml of 2 % carrageenan-saline solution in their back. They had free access to food and water, and were injected with ^{67}Ga citrate and ^{18}F-FDG on Day 1, 2, 4, 7 and 14 after the inoculation. Other 5 rats without inoculation were used for control.

At experiment day, the rats were injected with 111 kBq of ^{67}Ga citrate in 0.3 ml saline through their tail vein. Twelve hours later, the rats were injected with 5.55 MBq of ^{18}F-FDG and were killed 1 hr later. Tissue samples were excised, blotted to remove adhering blood, and weighed.

At first, ^{18}F radioactivity was counted just after the tissue sampling using a well-type NaI (Tl) autogamma counter with a 450-600 keV window, and corrected for decay. Forty-eight hours after the experiment when ^{18}F ($T_{1/2}$=109.7 min) had fully decayed, ^{67}Ga ($T_{1/2}$=3.2 day) radioactivity was counted using the autogamma counter with a 50-450 keV window without ^{18}F contamination and corrected for decay. The ^{18}F-FDG and ^{67}Ga citrate uptakes in the samples were expressed as differential uptake ratio (DUR).

Results and Discussion

Figure 1 and 2 show the ^{18}F-FDG and ^{67}Ga citrate uptakes in the carrageenan and turpentine induced inflammatory tissues, muscle of the right leg and blood sequentially after the inoculation, respectively. The ^{18}F-FDG uptakes in the carrageenan and turpentine induced inflammatory tissues rapidly increased until on Day 4, and then, the uptakes in the carrageenan became almost constant, but the uptake in the turpentine gradually decreased. The differential uptake ratios in the carrageenan were always higher than those in the turpentine. The ^{18}F-FDG uptakes in the muscle and blood were low and constant after the inoculation. On the other hand, the ^{67}Ga citrate uptakes in the carrageenan and turpentine similarly increased until on Day 4, and then gradually decreased. The differential uptake ratios in the carrageenan were slightly higher than those in the turpentine. The ^{67}Ga citrate uptakes in the blood were a little high but constant, and those in the turpentine were low and constant after the inoculation.

The characteristic sequence of tissue changes following the carrageenan or turpentine oil s.c. injection at about 24 hour, shows marked acute inflammatory response of increased vascular permeability and neutrophil infiltration, and at 3rd to 7th day shows chronic inflammatory response of granulation tissue of fibroblast network with neutrophil and macrophage infiltration[4-5]. In this study, ^{18}F-FDG accumulated in the experimental inflammatory tissue produced by carrageenan and turpentine oil. The uptake pattern was similar as ^{67}Ga citrate. It has been reported that ^{67}Ga citrate accumulates in inflammatory lesion produced by turpentine oil where the subcutaneous tissue is infiltrated with neutrophils and macrophages[6]. The same accumulation mechanism in the inflammatory lesion can be considered in ^{18}F-FDG. However, the result that the highest ^{18}F-FDG uptake in both inflammatory lesions were observed at Day 4, may indicate that ^{18}F-FDG accumulates greatly at chronic phase of inflammation characterized by granuloma of fibroblast network with macrophage and neutrophil infiltration.

References

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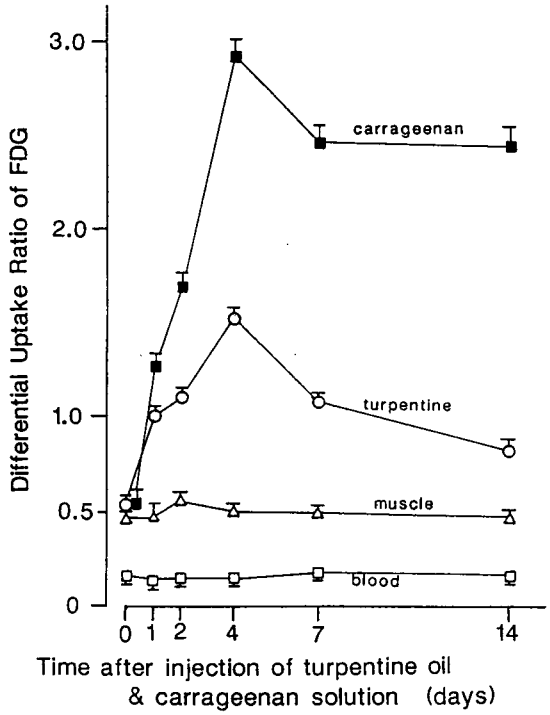

Fig 1. ^{18}F-FDG uptakes in rats sequentially after inoculation of carrageenan solution and turpentine oil.

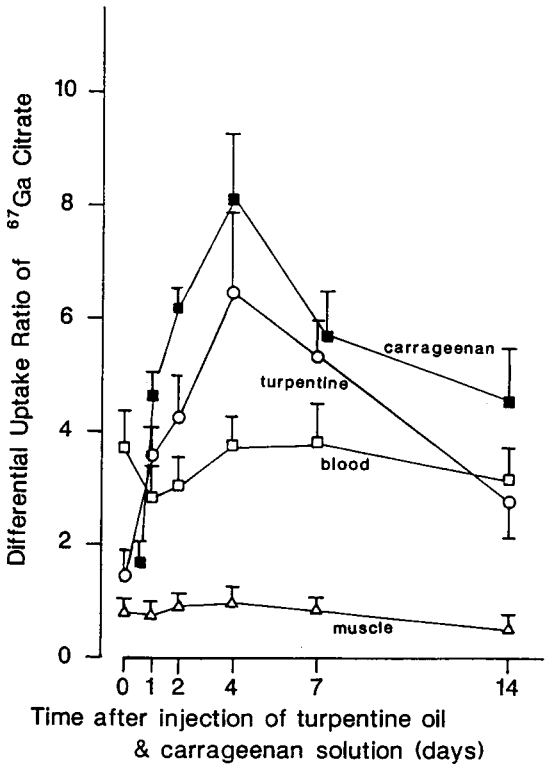

Fig 2. ^{67}Ga citrate uptakes in rats sequentially after inoculation of carrageenan solution and turpentine oil.