Technetium-99m-Labeled Anti-Fibrin Monoclonal Antibody Accumulation in an Inflammatory Focus

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Technetium-99m-labeled murine anti-fibrin monoclonal antibody (T2G1S Fab'), a thrombotic lesion seeking agent, incidentally demonstrated an inflammatory focus.

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Radiolabeled monoclonal antibodies (Mabs) have been clinically employed for diagnosis and/or therapy of cancer, acute myocardial infarction, inflammatory lesion, thrombosis and etc. (*1–10*). In this paper, a case in which there was intense uptake of a ^{99m}Tc-labeled Fab' fragment of anti-fibrin monoclonal antibody at the site of an insect bite is described.

CASE REPORT

A 35-yr-old male was a normal volunteer in a Phase 1 study of ^{99m}Tc-labeled anti-fibrin T2G1S antibody (Fibricint, Centocor, Malvern, PA). He had been well and his physical examination and laboratory data were normal except for a tender area of swelling on his left arm caused by an insect bite. The procedures, benefits and risks of the study were explained to him, and a signed informed consent was obtained. He had a negative skin test for T2G1S Fab' antibody and serum human anti-mouse antibody. A dose of 820 MBq of ^{99m}Tc-T2G1S Fab' intravenously was administered through his right arm and subsequent whole-body static images were obtained in the anterior and posterior projections at 5 and 30 min and 6 and 24 hr postinjection. These images incidentally demonstrated an area of intense uptake of radiotracer in his left arm (Fig. 1). No other abnormal uptake of radiotracer was identified.

DISCUSSION

We imaged several subjects using ^{99m}Tc-T2G1S Fab' antibody in Phase I and II studies. In one normal volunteer, an inflammatory focus accumulated significant amount of radioactivity immediately after intravenous injection for 24 hr. Although Mabs are expected to carry radionuclides to the desired target, there is nonspecific distribution of labeled antibodies in the liver, kidneys, bone marrow and other sites. Furthermore, there have been several papers (*8–10*) describing nonspecific uptake of the radiotracer. Antimyosin Mab has been reported to accumulate in antigen-negative soft-tissue tumors. This may be a nonspecific reaction possibly related to the increased blood flow and permeability to the area. The present case provides an example of extra-thrombotic accumulation of ^{99m}Tc-labeled anti-fibrin Mab. Although careful observation and more clinical experiences are necessary for understanding the exact mechanism of nonspecific distribution of radiolabeled Mabs, it is important that all antibody images be evaluated carefully to exclude nonantigen-related accumulation.

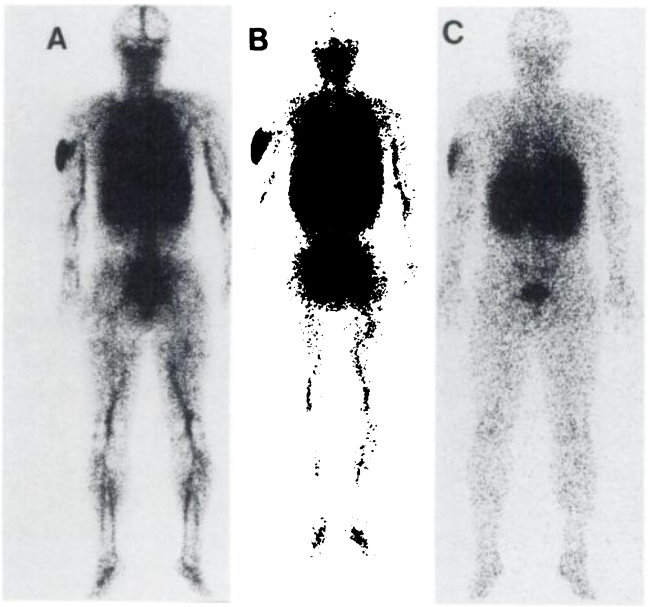

FIGURE 1. Whole-body posterior views after injection of ^{99m}Tc-T2G1S Fab'. Images were obtained at 30 min (A), 6 hr (B) and 24 hr (C) after intravenous injection. An area of intense accumulation of ^{99m}Tc-T2G1S Fab' is visualized in the left arm.

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SELF-STUDY TEST

Radiobiology and Radiation Protection

Questions are taken from the *Nuclear Medicine Self-Study Program I*, published by The Society of Nuclear Medicine

Your nuclear medicine clinic operates from 8AM to 5PM Monday through Friday and is closed on Saturdays and Sundays. On Friday afternoon at 1PM a technologist who was preparing ^{99m}Tc macroaggregated albumin dropped the [^{99m}Tc] pertechnetate stock vial. The vial, which contained 20 GBq (about 500 mCi) of [^{99m}Tc] pertechnetate, broke and its contents splashed on the floor, the wall, and the adjacent cabinets. The contaminated area was in front of the radioactive material storage and waste disposal area, which is about 4 m from the dose preparation area and the dose calibrator. Which of the following statements concerning this accident are true?

33. The amount of ^{99m}Tc spilled is too large to be ignored and to be allowed to decay to background levels.

34. The amount of ^{99m}Tc spilled is sufficiently great that the person who cleans up the debris and decontaminates the area should wear lead gloves, a lead apron, and special disposable clothing.

35. The exposure rate (mR/hour) in the dose calibrator/dose preparation area will be sufficiently great to require that work in this area be discontinued for the remainder of the day.

36. The contaminated area should be completely decontaminated to background levels before leaving for the weekend so that housekeeping personnel will not be exposed to excessive radiation levels.

SELF-STUDY TEST

Skeletal Nuclear Medicine

ANSWERS

ITEMS 1–5: Radiation-Induced Thyroid Cancer

ANSWERS: 1, F; 2, T; 3, F; 4, F; 5, T

Thyroid cancer, in its papillary form, is the predominant radiation-induced entity, with a lesser increase in follicular cancer. The incidences of medullary and anaplastic cancers are not increased by radiation exposure. The etiology of individual cases of thyroid cancer cannot be attributed to radiation by any pathological criteria currently known. Exposure to ^{131}I has not been shown to cause an increased incidence of thyroid cancer in medically treated human subjects, whereas x-ray therapy has been shown to be a potent cause, especially in the youngest exposed individuals, females being more sensitive than males. Adolescents are less sensitive than younger children. The relative risk following external irradiation is at least three times greater than that following irradiation by internal emitters.

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ITEMS 6–10: Calculating Probability of Causation

ANSWERS: 6, T; 7, T; 8, F; 9, T; 10, F

The radioepidemiologic tables that provide probability of causation (PC) values were designed to estimate the likelihood that a person who has or has had a "radiation-related" cancer and who received a specific dose of radiation prior to its onset developed the disease as a result of the irradiation. Probability of causation tables pertain to a particular cancer in a particular individual.

The relative risk per unit of radiation dose can be used to determine the PC that a given cancer is the result of a previous exposure; this is calculated by use of the following relationship:

$$PC = R/(1 + R),$$

where R is the relative risk due to radiation exposure and the spontaneous risk is 1.

Patients exposed to diagnostic and therapeutic radiation are different from the general population to some degree. Because of selection factors other than radiation, PC values based on radiation risk factors and

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