Blood cell labeling

1

INTRODUCTORY REMARKS.

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During the past twenty years, various radiopharmaceuticals have been utilized for blood cell labeling, and a variety of different cell fractions can be labeled with reasonable reliability and used in specific disease states. Radiolabeling of red cells and the advance of their clinical application have been made in in vitro and in vivo studies. Technetium-99m-labeled red cells are used in the field of cardiovascular nuclear medicine, blood pool imaging, detection of vascular malformations, red cell mass determination, detection of gastrointestinal bleeding, and of hemangioma. Heat-damaged ^{99m}Tc-RBC were utilized in spleen imaging, accessory spleen localization, and detection of GI bleeding. Iron metabolism and RBC survival studies have been widely carried out by ^{59}Fe and ^{51}Cr.

The radiolabeling of platelets has also been studied for many years with megakaryocytes labeled in vivo and with direct platelet labels in vitro, which requires separation of platelets from whole blood. Imaging detection of thrombosis has been made possible with indium-111-labeled platelets, in which intracardiac and intracerebral thrombosis, and platelet interaction for atherosclerosis are included.

Techniques for localizing inflammatory lesions had relied upon ^{67}Ga until ^{111}In-oxine labeled leukocytes was described by Thakur et at. In-111-labeled leukocytes are the agent of choice for evaluation in patients with fever of unknown origin, osteomyelitis and inflammatory bowel disease. Besides those, lymphocyte and leukemic cell labeling techniques are developing. Cellular labeling by using monoclonal antibodies would be under development, which might make possible specific imaging due to cellular function and the clinical diagnostic application might be expected in the near future.

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DYNAMICS OF RED CELL PRODUCTION AND DESTRUCTION ANALYSED BY USING RADIONUCLIDE LABELED RED CELLS

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Ferrokinetics with Fe-59 and red cell survival study with Cr-51-RBC were performed. Fe-59,Cr-51-RBC and Fe-59-retics were used for diagnosing the ineffective erythropoiesis in 106 patients with various hematologic diseases. Whole body and transverse linear scanning 10-15 days after injection of Fe-59 and Cr-51-RBC showed high incidence of bone marrow iron retention and Cr-51-RBC uptake in myelodysplastic syndromes, myelofibrosis and various hemolytic disorders. Effective erythropoietic ratio obtained by dividing red cell iron renewal rate with PIT was proved to be a better index to evaluate the efficiency of erythropoiesis than %RCU. Rapid disappearance of Fe-59-retics in hemolytic disorders indicates the increased destruction of young red cells. Such young red cell destruction seems to take place in the bone marrow, which means ineffective erythropoiesis. In addition to the above, In-111-RBC was used for the visualization of the site of GI bleeding. The focus of GI bleeding which was not detected by conventional examinations in a patients with severe blood loss anemia was clearly demonstrated by In-111-RBC scintigram.

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MULTIPLE PROBES TO INVESTIGATE VARIABLE HEMODYNAMICS AND EXTRACTION IN THE SPLEEN WITH DIFFERENT KINDS OF LABELED BLOOD CELLS.

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Techniques of doubly tracing different blood cells' kinetics were applied to achieve multiple probes into variable hemodynamics and destruction of these cells in the spleen. Several methods to measure splenic blood flow rate were examined to disclose the dissociation involving pathophysiological meanings of the tracer's extraction or dynamics change. Simultaneous tracing of red cell and plasma through the spleen revealed red cells stay left behind fast exiting plasma in a concentrated state as a common factor to accelerate their destruction among several dyscrasias. Platelets' pooling, on the other hand, demonstrated different relationship with their destruction in different degree in differnt disorders developing thrombocytopenia. The proportion of denatured RBCs confronting intrasplenic delayed stasis related linearly to their extraction efficiency in both ^{51}Cr-NEM-RBCs and ^{99m}Tc-anti-D-RBCs kinetics on simultaneous measurement of their kinetics. The kinetics of anti-D-RBCs was a valuable indicator to examine macrophage Fc-receptor function mainly in the spleen so far as the effect of high dose intravenous γ-globulin in ITP was concerned on simultaneous examination with ^{111}In-Ox-platelets kinetics. Thus multiple probes were required and valuable to bring into multiple focuses on complicated manifestation of splenic functions on both diagnostic and therapeutic standpoints of view.