Nucleic Acid Synthesis in Bone Marrow Cells of Various Hematological Disorders

F. TANAKA and M. OMINE

Third Department Internal Medicine, University of Tokyo, Tokyo

DNA synthetic rate in the normal human bone marrow cells determined by measuring the amounts of tritium labelled thymidine incorporated into DNA during one hour incubation at 37°C was 13.0 ± 0.92 $\mu\mu$ moles per hour for 10^6 immature cells. The DNA synthetic rate in the bone marrow cells was reduced in iron deficiency anemia, pernicious anemia and in acute and chronic myelogenous leukemia. The decreased DNA synthetic rate in iron deficiency anemia was recovered by incubating the iron deficient bone marrow cells in the normal plasma or in the plasma of iron deficiency anemia containing 100 μg/dl of iron, indicating a necessity of iron for the normal DNA synthetic activity of human bone marrow cells.

In 5 cases of aplastic anemia, DNA synthetic rate was within normal limit when it was measured on the basis of immature bone marrow cell count.

Incorporation of ^{3}H-thymidine into DNA was influenced by the changes in de novo pathway of thymidine monophosphate as well as by the changes in intracellular thymidine pool size. Thus, disturbance of the formation of thymidine monophosphate from deoxyuridine monophosphate by 5-fluorouracil or methotrexate markedly increased the incorporation of ^{3}H-thymidine into DNA. Increase in thymidine pool size brought about by adding unlabelled thymidine into incubation medium also caused an increase in the incorporation parallel to the amount of thymidine added. These factors modifying the incorporation of ^{3}H-thymidine into DNA should be considered in determining the DNA synthetic rate by measuring the amount of ^{3}H-thymidine incorporated.

RNA synthetic rate measured by an incorporation of ^{3}H-uridine into RNA was markedly affected by the maturity of bone marrow cells. It was considered very difficult, therefore, to give pathophysiological meanings on the RNA synthetic rate of bone marrow cells.

Pathophysiology of Bone Marrow as viewed from Lipid Metabolism

M. KIBATA

Department of Internal Medicine, Okayama University Medical School, Okayama

The present study contains the Lipids metabolism of bone marrow cells in some blood discrasias, a part of that have already reported in the last Annual Meeting of this Society.

In considering Lipids accumulation in the bone marrow of hypoplastic anemia, metabolic disorder of lipid may have an important relation to blood cell production, directly or indirectly.

Bone marrow cell has an ability to incorporate ^{14}C-acetate into long chain fatty acids or cholesterol and esterify the newly synthesized fatty acids to lipids; free fatty acids, phospho-lipids, glyceride and esterified cholesterol, in vitro. Then, I studied lipid metabolism of bone marrow cells incubated in vitro in some cases of blood disorders.

^{14}C incorporations into total lipids per 10^7 nucleated cells were recovered almost equally in controls (5 male adults) hypoplastic anemia (4 cases) iron deficiency anemia (2

cases) and so on, but in acute leukemias, recovered ^{14}C was diminished as low as 38% of control group.

Percentage of ^{14}C incorporation into major lipid classes were studied on fractionated FAA (free fatty acid), PL (phospholipids), G (glyceride) FC (free cholestreol) and EC (esterified cholesterol) with thin layer chromatography. Mean values of control were 50% FFA, 25% PL and 15% G. A slight increased percentage was detected in hypoplastic anemia, on the contrary a decreased percentage in iron deficiency anemia in the glyceride.

Net counts of ^{14}C incorporated into major lipids classes were calculated by per 10^7 nucleated cells in some group of blood discrasias. Into the glyceride, hypoplastic anemia cells incorporated more radioactivities (8672 cpm, in control 5775 cpm) and iron deficiency anemia did low counts (2473 cpm).

On the other hand, each lipid took a characteristic percentage of newly synthesized fatty acids. Free fatty acids of control group were consisted of mainly myristic and palmitic acid (about 80% of recovered cpm). Chief elements of fatty acids esterified to phospholipids were stearic acid (2%) and 20 carbons and more longer chain fatty acids (53%). Glyceride fatty acids were widely disperesed, but main ones were palmitic and 18 carbons fatty acids. The percentage of ^{14}C in oleic acid of it was more increased conspicuously than of other lipids classes.

In this report, the author insisted on that lipid metabolism of bone marrow cells crossly take part in blood cell production; for example, bone marrow cells of hypoplastic anemia are declined to produce neutral fat, resulting in lipid accumulation, on the contrary, tumor cells of acute leukemia are more likely to be thought to utilize newly synthesized fatty acid on its life energy, and some difference are conceivable in the course of fatty acid synthesis and its esterification on condition of bone marrow disorders with cross relation to cell productivity.

Studies on Bone Marrow Function with ^{59}Fe Ferrokinetics and ^{99m}Tc Sulfur Colloid

I. Iwasaki and H. Yoshioka

The Second Department of Internal Medicine, Okayama University, Okayama

This paper presented the results of experiments of the scintillation camera and ^{59}Fe ferrokinetics regarding on the bone marrow functions in hematological disorders.

The normal subjects showed clear pictures of pelvis and skull, and were able to delineate to elbow joint and knee joint with nuclear and obscure figures.

Generally, the diffuse type pictures with lower density of ^{99m}Tc spots were demonstrated in the patients with hypoplastic anemia. However, some cases of hypoplastic anemia were characterized with the islet form patterns of bone marrow pictures. The former had a low hematopoietic functions been indicated with myelogram, peripheral blood pictures, and ^{59}Fe ferrokinetics. The latter showed a type of bone marrow arrest in our classification of hypoplastic anemia with a closer hematological data to normal person. The ^{59}Fe uptake of this type into the bone was more active and cumulative, and ^{59}Fe utilization rate was higher then former.

The patients with erythremia and congenital hemolytic anemia, whose erythropoiesis had increased, exhibited distinct and clear bone marrow distributions including hand and foot.

Very intense and high density figures, or obscure and unclear pictures were demonstrated in the patients with acute myelocytic leukemia depending on the status of diseases such as an acute stadium or a remission by