DEMONSTRATION OF BONE INFARCT BY SCINTILLATION SCANNING WITH ^{99m}Tc COLLOID: A CASE REPORT

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The distribution of intravenously injected colloids throughout the reticuloendothelial system is dependent on a number of factors. Among these are particle size and relative blood flow to the various regions of the body containing phagocytic cells (*1*). The usual distribution of the sulfur colloid of ^{99m}Tc is approximately 85 to 90% in the liver and the remainder divided between spleen and bone marrow (*2*). The highest concentration in the marrow usually correlates well with the distribution of active hemopoietic elements, i.e., in the axial skeleton (*3*). Some of the colloid is also found in the femora, scapulae, humeri and skull. When active marrow sites undergo expansion such as in hemolytic anemia, polycythemia and in some cases of leukemia, there may be peripheral extension of the regions of radiocolloid deposition.

Lack of colloidal uptake has been demonstrated in cases where high doses of radiation have been applied for therapeutic purposes and when the marrow is infiltrated with metastatic carcinoma (*4*). It is the purpose of this report to record a situation in which scintillation scanning showed the presence of a bone infarct with consequent aseptic necrosis of the femoral head, a complication of sickle cell thalassemia. Because of diminished perfusion of the affected area by the circulating blood, less radioactivity was deposited in this region compared with the opposite, unaffected bone.

Case report—BNL #80596R. The patient was 23 years old when first admitted to the Medical Research Center, Brookhaven National Laboratory, on July 29, 1963, because of pains in the arms and legs and occasionally in the chest and abdomen since childhood. The pains had become worse in the past 1½ years.

Ten years before, the patient suffering from leg ulcerations which healed spontaneously was admitted to a hospital for pneumonia. She was told she had "low blood" and received transfusions. She was able to continue in school and afterward worked at a clerical job without much difficulty.

In 1962, after a bout of abdominal pain, she was told she had an ulcer. The following year, in January, she was admitted elsewhere because of postpartum hemorrhage following a stillbirth. A diagnosis of partial Sheehan's Disease was made. It was thought that she had a deficiency of ACTH and FSH. Thyroid studies were normal. She was again told her blood was "low," but received no transfusions and was placed on steroid therapy.

Her family history is of interest because two cousins on her father's side had anemias and required transfusions.

On admission to the Hospital of the Medical Research Center, the physical examination was essentially normal. Neither the liver nor the spleen was palpable. Laboratory data included hemoglobin 6.9 gm%, hematocrit 22%, white blood count 9,400/mm^3, reticulocytes 7.3 to 9.4%, platelets 500,000 to 600,000. Many target cells were noted in the blood smear along with nucleated red cells. A sickle cell preparation was positive. Bone marrow preparation showed erythroid hyperplasia.

Hemoglobin paper electrophoresis showed S only. Alkali-resistant hemoglobin was 4.0% and A_2 was 5.8%. The patient's mother had hemoglobin A only with A_2 3.0% and alkali-resistant hemoglobin 1.1%. The patient's father had hemoglobin S + C and alkali-resistant hemoglobin 0.8%. A_2 was not measured in the father.

Readmission occurred on September 10, 1963, for sickle-cell crisis. Six pints of blood were transfused, and the prednisone increased with relief of symptoms. Laboratory data showed an increase in hemoglobin to 15.5 gm% and hematocrit to 53%. The serum iron was 232 μg% with unsaturated iron-binding capacity 100 μg% and total iron-binding capacity 332 μg%; serum bilirubin was 1.08 mgm%. The patient was discharged October 1, 1963.

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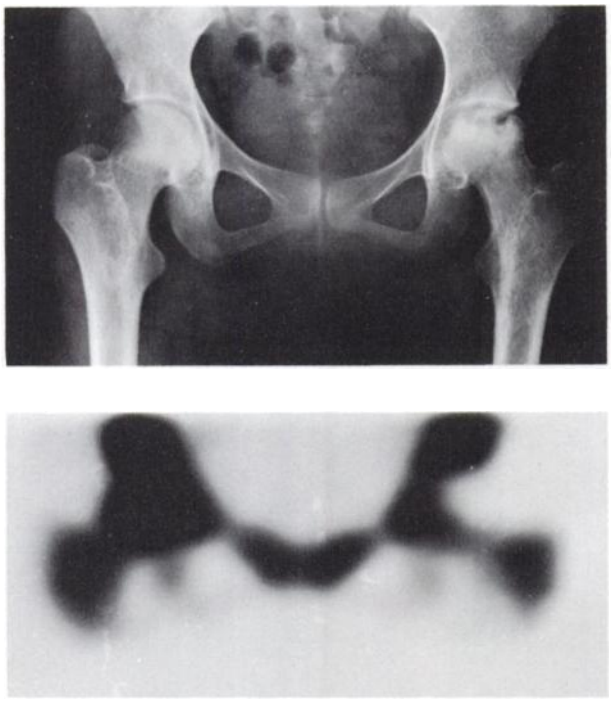

FIG. 1. Comparison of roentgenogram (top) with marrow scan (bottom) of hips. There is decreased deposition of radiocolloid in left femoral head at site of aseptic necrosis in comparison with right femur.

Pain in the left knee and hip began in December 1963. Roentgenograms of the hips and pelvis showed a bone infarct involving the left femoral head with irregularity of the articular surface and increased density in the subcortical region. Subsequent roentgenograms on November 12, 1965, showed progression and the last examination on July 10, 1966, revealed no further change. The patient walked with a slight limp after this episode.

A scan of the bone marrow distribution in the hips was performed on July 11, 1966, using 12 mc ^{99m}Tc-sulfur colloid. The patient's marrow was generally hyperactive as was shown by a high uptake of the radiocolloid in the usual sites and with some increase in the lower extremities. A marked disparity in radioactivity concentration was noted in the hips, with much less concentration on the left at the site of the radiologically visible infarct (Fig. 1).

DISCUSSION

Visualization of the avascular region in the left femoral head in this patient was undoubtedly aided by two factors. First, the hemolytic anemia was a stimulus for erythroid hyperplasia which increased marrow uptake of the radiocolloid in most sites. Second, the patient was rather young at the time of the scan; therefore, more marrow activity was present in the normal hip region than is often found in older patients (*5*).

Marrow scanning appears to have potential as a diagnostic aid in suspected impairment of blood supply to the femoral head and neck in such conditions as aseptic necrosis and slipped capital femoral epiphysis. Since these conditions usually occur in the younger age group, there should normally be a good uptake of radioactivity in the hip region. It is likely that scintillation scanning could demonstrate an abnormality before changes are seen in roentgenograms as often happens with pulmonary embolism, but this remains to be tested.

A definite limitation in the use of marrow scanning for this purpose is the age of the patient. Scans on elderly patients in the 50–70-year group usually demonstrate bilateral reduced or absent uptake of the radiocolloid over the femoral head, possibly in association with a reduced total volume of functioning marrow.

SUMMARY

An instance of aseptic necrosis of the hip following a bone infarct has been demonstrated in a patient with sickle-cell thalassemia using scintillation scanning with a technetium-sulfur colloid. It is suggested that in young patients this method may prove to be very sensitive for detecting vascular insufficiency in this region.

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