

SPLEEN SCANNING WITH RED CELLS SIMULTANEOUSLY ^{51}Cr -TAGGED AND HEAT-TREATED

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Radioisotopic scanning of the spleen has been a valuable aid in determining the size, shape, position and, at times, condition of the organ in various pathological conditions. The first successful splenic visualization in 1960 was accomplished by Johnson and associates (1) using anti-RH D sensitized red cells. An improvement on this method was reported by Winkelman and associates (2), who used heat-damaged erythrocytes labeled with ^{51}Cr . The cells were first labeled with ^{51}Cr and then heated at 50°C for 30 min. These methods, using sensitized RBCs and ^{51}Cr -labeling were time consuming. In addition, ^{51}Cr -labeled red cells, damaged by heat at 50°C or so for periods of time varying around 30–60 min gave erratic results. Wagner and associates (3) in 1964 introduced a simplified method for spleen scanning using 1-mercuri-2-hydroxy-propane labeled with ^{197}Hg . While this method had the advantage of rapidly denaturing and labeling RBCs, it had the disadvantages of concentrating radioactivity in the kidneys and of not being available for general use by the nuclear clinician.

Ham and associates (4) showed that at temperatures from 47 to 50°C , changes in red cells varied and depended on the temperature and duration of heating whereas at temperatures of 51 to 65°C , changes always occurred even when the sample was subjected to "rapid heating." This confirmed the observation of Schultze (5) that heating at these temperatures produced division and fragmentation of the erythrocytes. The purpose of this study was to review previous spleen-scanning methods used at Walter Reed General Hospital and possible other methods described in the medical literature with the goal of selecting a satisfactory technique for future scanning. Certain modifications in technique were introduced. Using a method in which the RBCs are heat-denatured and tagged with ^{51}Cr simultaneously within a 10-min period, we have obtained scans that

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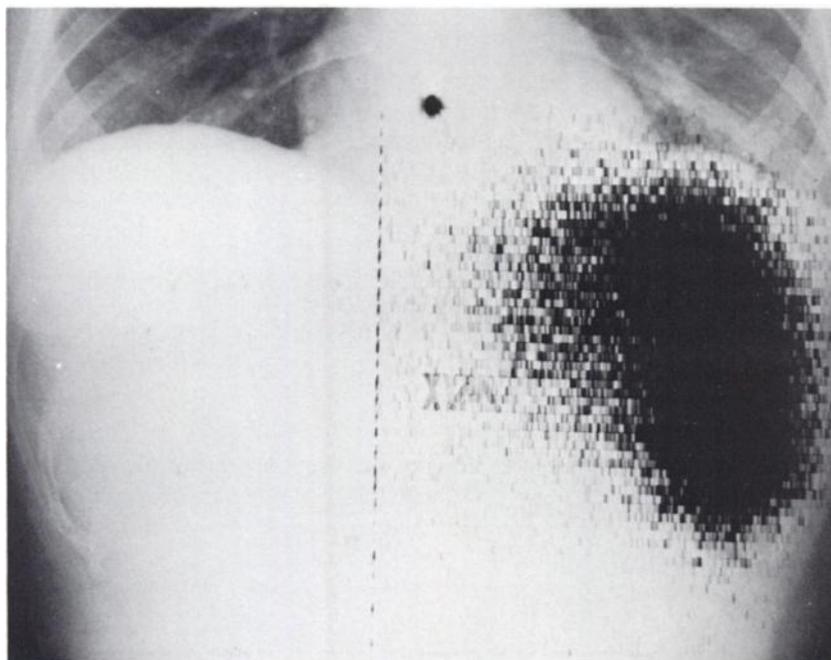


FIG. 1. Anterior spleen scan superimposed on patient's x-ray. Spleen was normal in size and in isotopic distribution.

are consistently of high quality. We believe that this method overcomes the previous objections to the ^{51}Cr -tagged, heat-denatured red-cell method of spleen scanning.

MATERIALS AND METHODS

Twenty milliliters of patient's blood is mixed with 4 ml of ACD solution in a sterile bottle. Three hundred microcuries of ^{51}Cr (in the form of $\text{Na}_2\ ^{51}\text{CrO}_4$) is added. The blood is then incubated in a 56°C water bath for 10 min. After incubation, 100 mg of ascorbic acid is added and the mixture allowed to cool to room temperature. Twenty milliliters of blood containing the heat damaged ^{51}Cr -tagged erythrocytes are then injected intravenously and photoscanning is begun 15 min post dose. Anterior, posterior and left lateral projections are obtained. Repeat photoscans can be performed at various times thereafter.

RESULTS

Using splenic sequestration as an index, the cellular damage inflicted by incubating at 56°C for 10 min appeared to be very nearly the same as when cells were incubated at 50°C for 60 min. *In vitro* studies indicated that prior tagging of erythrocytes at room temperature was not required. Tagging was excellent during the damaging process. Since the residual ^{51}Cr -chromate ions presented no interference with the subsequent scanning, it is not necessary to wash the red cells. Blood smears of the heat treated RBCs showed spherocytosis, dacriopoikilocytes (tear drop cells) and fragmentation (6). Of the 52 patients studied, the spleen was visualized in 100% of the cases. Referral for spleen scans was

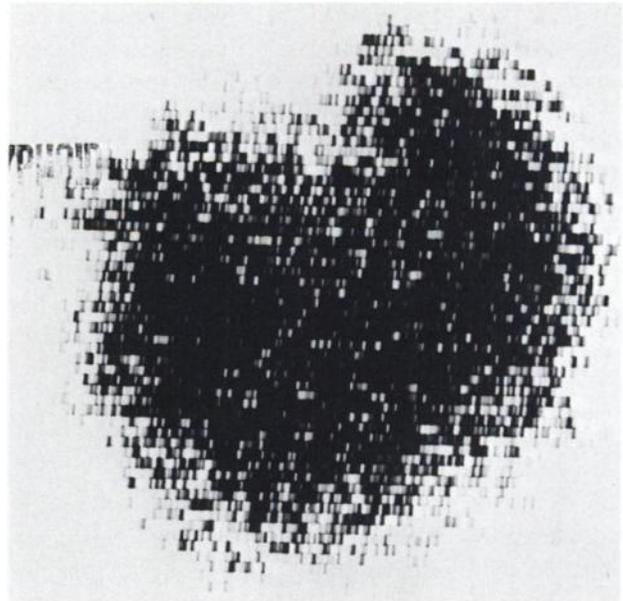


FIG. 2. Left lateral view of enlarged spleen in patient with infectious mononucleosis. Superior border is deeply notched.

primarily for confirmation of suspected splenic enlargement, possible Hodgkin's involvement or suspected secondary carcinoma. External counting curves obtained on patients referred for splenic scans showed that maximum radioactivity was reached in approximately 30 min. An average half-time of 22 min for ^{51}Cr blood clearance was obtained.

CASE REPORTS

Case 1. A 51-year-old female with chronic anemia, SA hemoglobin, CHF, pericarditis and chronic liver disease was scanned for questionable splenomegaly. Hematocrit at time of scan was 27%. The scan showed a normal spleen (Fig. 1).

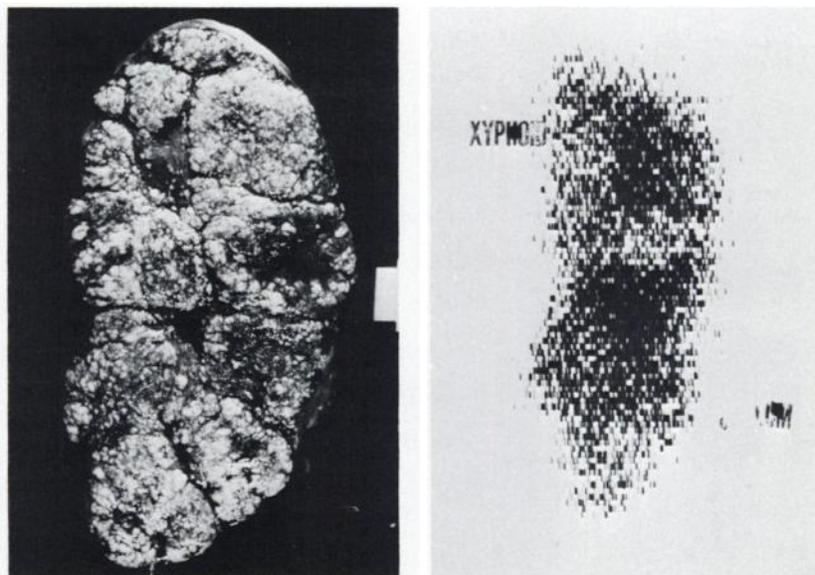


FIG. 3. Gross anatomical appearance (left) of enlarged spleen which was involved with Hodgkin's disease is positioned beside preoperative spleen scan. Splenomegaly with multiple defects suggesting parenchymal replacement is shown by scan.

Case 2. A 19-year-old male with pancytopenia, secondary to hepatitis and infectious mononucleosis, was referred for spleen scan to rule out splenomegaly. Hematocrit was 32%. The scan showed a diffusely enlarged spleen (Fig. 2).

Case 3. This 23-year-old female with hematocrit of 26% had spleen palpable 8-9 cm below the costal margin. A scintiscan of the spleen showed marked splenomegaly with multiple large filling defects. Pathological examination of the spleen after splenectomy revealed Hodgkin's disease, mixed type, and splenic parenchymal changes consistent with hypersplenism (Fig. 3).

SUMMARY

The role of splenic photoscans has been well documented by a number of workers (2,7-12) but has not been extensively used because of the time required for preparation and the lack of reproducible results. We have described a rapid method for simultaneously labeling with ⁵¹Cr and heat-denaturing red cells and subsequent scanning in a total elapsed time of less than 1 hr.

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