Technetium-99m Antimony Colloid for Bone-Marrow Imaging

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Technetium-99m antimony colloid was prepared in our laboratory for bone-marrow imaging. Optimal production of colloid particles of size range 1–13 nm was achieved by the use of polyvinylpyrrolidone of mol. wt. 44,000. Electron microscopy was used to size the particles. Studies in rabbits showed exclusive concentration in the subendothelial dendritic phagocytes of the bone marrow. Pseudopods from these cells were found to traverse interendothelial junctions and concentrate colloid from the sinusoids. Imaging studies of bone marrow in rabbits showed the superiority of the Tc-99m antimony colloid over the much larger colloidal particles of Tc-99m sulfur colloid. Tissue distribution studies in the rat confirmed that bone-marrow uptake of Tc-99m antimony colloid was greater than that of Tc-99m sulfur colloid, although blood clearance was much slower.


Currently available bone-marrow imaging agents all have major shortcomings that have prevented widespread clinical acceptance. Technetium-99m sulfur colloid (Tc-SC) is the agent of choice for reticuloendothelial (RE) imaging of liver and spleen, but uptake in bone marrow is poor (1). Indium-111 chloride localizes in bone marrow, but there is doubt regarding the uptake in RE relative to erythropoietic tissue, and it has the added disadvantages of slow blood clearance and relatively high radiation dose to the marrow (2, 3). Indium-113m colloid localizes in RE marrow but the short half-life and energetic gamma emission limit its usefulness (2). Technetium-99m phytate has been proposed for bone-marrow imaging (4), but more recent studies have demonstrated uptake in compact bone rather than marrow (5).

A critical factor in determining localization of any particle in the RE cells of bone marrow is a diameter of less than 50 nm (6). Technetium-99m antimony colloid (Tc-SbC) particles fall within this size limit (7), and the present study was undertaken to evaluate Tc-SbC for bone-marrow imaging.

MATERIALS AND METHODS

Preparation of Tc-99m antimony colloid. The method of Warbick (8) was followed with modifications. Briefly, preformed antimony sulfide reagent was prepared by saturating 120 ml of boiled water for injection with hydrogen sulfide gas. Twenty milliliters of 1% aqueous antimony potassium tartrate and 10 ml of 3.5% aqueous polyvinylpyrrolidone (PVP) of mol. wts. 10,000, 44,000, or 360,000 were added and the excess hydrogen sulfide removed by purging with nitrogen gas for 30 min. The reagent was sterilized by membrane filtration (0.2 μm). Antimony colloid stabilized with PVP of mol. wts. 10,000, 44,000, and 360,000 was designated Sb-10, Sb-44, and Sb-360, respectively. Antimony colloid prepared by the method of Warbick (Sb-W) was stabilized with PVP of mol. wt. 44,000 rather than 40,000 as in the published method (8).

Sodium pertechnetate (Tc-99m) in 1.5 ml saline was added to 1.5 ml of the preformed antimony sulfide reagent in a 10-ml reaction vial, followed by 0.2 ml of 1.0 N HCl. Final pH of the mixture was 1.3. The mixture was autoclaved at 132°C for 10 min, cooled, and 1.0 ml of buffer* was added to bring the pH to 6.2.

Preparation of Tc-99m sulfur colloid. To 1.4 ml of 0.5 N HCl in a 10-ml reaction vial was added 1.8 ml of a solution containing sodium thiosulfate, 4.1 mg/ml, gel-
atin, 22.2 mg/ml, and sodium perhenate, 0.81 mg/ml.
Sodium pertechnetate in 2 ml of saline was added and the mixture heated in a boiling-water bath for 4 min. After cooling, 4.8 ml of buffer was added. The solution was then purged with nitrogen, autoclaved at 132°C for 10 minutes, and allowed to cool.

**Quality control.** Radiochemical purity of all colloid preparations was determined using ascending thin layer chromatography. Colloid samples were spotted 1 cm from the end of the 1-× 10-cm thin-layer strip, dried in a stream of air, and developed with 100% acetone (for Tc-SbC) or 85% methanol (for Tc-SC). After development, the strips were cut into lower and upper halves and each was counted in a gamma spectrometer. Radiochemical purity was calculated by expressing counts on the lower half as a percentage of counts on the whole strip.

Pyrogen testing was performed on samples of labeled colloid preparations using the standard USP test in rabbits; tests for sterility were performed by USP microbiological methods.

**Bone-marrow imaging.** Whole-body imaging studies were performed in rabbits. Female New Zealand white rabbits weighing 4.0–4.5 kg were imaged at 5-min intervals for 1 hr after injection of 4.0 mCi of radiocolloid (in 1.5–2.5 ml) into a marginal ear vein. Technetium-99m SbC preparations were stabilized with PVP of molecular weight of either 44,000 or 360,000, and images were compared with each other and with Tc-SC images. All animals were anesthetized by intermittent intravenous administration of steroidal anesthetic (alphadalone acetate 3 mg/ml). A large-field gamma camera fitted with a low-energy, all-purpose collimator allowed visualization of the whole body with the exception of the head.

**Tissue distribution studies.** These were done in 48 female Sprague–Dawley rats (weight range: 230–300 g). Doses of ~3 μCi were administered by tail vein in volumes of 0.2 ml, and the rats were killed by etherization and cardiac puncture at various times after injection. Bone-marrow samples were obtained from the femoral shafts after removal of the upper and lower ends of each femur with a fine saw. One of the empty shafts was flushed with water, dried, and weighed. Other tissues of interest were removed and weighed, and the radioactivity of all samples was assayed in a sodium iodide well counter, with appropriate concern for counting statistics and radioactive decay. Results were expressed as percentage uptake of injected dose per whole organ, using the mean and standard deviation from six rats for each time interval. Marrow, blood, bone, and lymph nodes were not studied as whole organs; figures for percentage of body weight were obtained from a study by Caster et al. (9): blood, 4.95% of body weight; marrow, 0.35%; bone (less marrow), 5.62%; and lymph nodes, 0.07%.

**Blood clearance rate.** A modification of the method of Triplett et al. (10) was used for continuous monitoring of the level of radiocolloid activity in the blood of rats. Part of a 70-cm length of polyethylene catheter (0.6 mm i.d.) was wound into a 4-cm-diameter coil and filled with heparinized saline. The free ends were used to catheterize a carotid artery and jugular vein of an anesthetized rat to form a shunt. The animal was then heparinized to prevent clotting within the cannula and left to stabilize for 30 min. The looped cannula was then placed between the faces of two opposed gamma scintillation probes that were fitted with additional lead shielding and set for different detection sensitivities. Count rates were monitored on a chart recorder that was later calibrated in cpm for each channel.

Radiocolloid, ~60 μCi, was injected rapidly into the tail vein of a prepared rat, followed by a 0.2-ml saline flush. Circulating blood radioactivity was monitored until the count rate approached background levels.

**Electron microscopy.** Examination of the colloid. Samples of the radiocolloids were applied on carbon-stabilized copper grids (300 mesh) coated with Formvar. The colloid was allowed to dry partially on the surface of the grid, which was then washed in distilled water to remove water-soluble material. The grids were then examined on an electron microscope at an accelerating voltage of 80 KV.

Negative staining techniques were performed in a pilot study. Colloidal particles were collected on copper grids as described above. The grids were then placed on a droplet of 2% phosphotungstic acid (pH 7.2).

The dimensions of the colloidal particles were determined by manual measurement on high-resolution micrographs of samples of the radiocolloids.

**Preparation of bone marrow.** One hour after injection of labeled colloid into rats, small fragments of bone marrow were fixed in 2.5% glutaraldehyde in 0.1 M cacodylate buffer (pH 7.4) for 16 hr. Specimens were then washed in buffer and postfixed for 1 hr in 1% osmium tetroxide in cacodylate buffer (pH 7.4). After dehydration in graded solutions of ethanol the samples were embedded in Araldite. Sections were cut on an ultramicrotome, stained with lead hydroxide, and examined on an electron microscope at 60 KV accelerating voltage.

**RESULTS**

**Particle size.** Technetium-99m antimony colloid particles stabilized with PVP of mol. wt. 44,000 are shown in the electron micrograph in Fig. 1. Ultrastructural examination with negative staining techniques revealed that the distribution of particle dimensions was similar to that observed in unstained preparations.

Particle size distributions for representative samples of three different Tc-99m antimony colloid preparations
are shown in Fig. 2. Colloid prepared by the modified method using PVP of mol. wt. 44,000 (Sb-44) has a curve of particle size distribution very similar to that of colloid prepared by the method of Warbick (Sb-W), with a peak at 6 nm diameter, and range of 1–13 nm. In contrast, the distribution curve of colloid prepared with PVP of mol. wt. 360,000 (Sb-360) does not have a single definite peak, but has several minor peaks spread across a size range from 1 to 17 nm.

Tc-SbC prepared with PVP of mol. wt. 10,000 (Sb-10) precipitated when autoclaved during the labeling procedure. Heating in a boiling-water bath for more than 15 min also produced precipitation, while heating for less than 15 min resulted in poor labeling efficiency. Further studies of Sb-10 were therefore abandoned.

Bone-marrow imaging. Posterior whole-body images of rabbit bone marrow are shown in Figs. 3 and 4. All radiocolloid preparations were studied under the same imaging conditions in each animal. Figure 3 shows a comparison of images obtained with Tc-SC (A) and Tc-Sb-W (B), at 5 and 30 min after intravenous injection. Figure 4 shows 5- and 30-min images of Tc-Sb-44 (A) and Tc-Sb-360 (B). The degree of bone-marrow uptake is comparable in all three Tc-SbC preparations in the rabbit, and is superior to that of Tc-SC.

In Fig. 3B, kidney activity is evident 5 min after injection of Tc-Sb-W, and persists after 30 min. Kidney uptakes of Tc-Sb-44 (Fig. 4A) and Tc-Sb-360 (Fig. 4B) at 5 min are weaker than that of Tc-Sb-W, and have cleared completely after 30 min.

Spleen uptake of Tc-Sb-360 (Fig. 4B) is much lower than spleen uptake of either Tc-Sb-44 or Tc-Sb-W.

Rat tissue distribution. The distribution of Tc-Sb-44 and Tc-SC activity in rat organs following intravenous administration is shown in Tables 1 and 2. The results for Tc-SC correlate well with those from a previous study.

FIG. 1. High-resolution electron micrograph of Tc-99m antimony colloid particles. Original magnification 279,300.

FIG. 2. Particle size distribution of Tc-99m antimony colloids stabilized with PVP of mol. wt. 44,000 (Sb-44) or 360,000 (Sb-360), compared to Tc-99m antimony colloid prepared by the unmodified method of Warbick (Sb-W).

FIG. 3. Bone-marrow images in rabbit 5 and 30 min after intravenous administration of (A) Tc-99m sulfur colloid and (B) Tc-99m antimony colloid prepared using the unmodified method of Warbick (Sb-W).
The distribution of radioactivity at 1 hr in the other RE organs studied was as follows: liver uptake of Tc-Sb-44 was 74.6%, and that of Tc-SC was 90.4%; spleen uptake of Tc-Sb-44 was 6.3% and that of Tc-SC was 1.7%. Uptake of Tc-Sb-360 in the rat spleen was shown to be 14.9%, which is 2.4 times Tc-Sb-44. This finding contrasts with imaging studies in the rabbit (Fig. 4), where splenic uptake of Tc-Sb-360 was seen to be very much lower than that of Tc-Sb-44.

Blood clearance of Tc-SbC was slower than clearance of Tc-SC in the rat. The monitoring of blood clearance in cannulated rats revealed that 90% clearance of in-

### TABLE 1. RAT TISSUE DISTRIBUTION OF Tc-99m SULFUR COLLOID* FOLLOWING INTRAVENOUS ADMINISTRATION

<table>
<thead>
<tr>
<th>Tissue</th>
<th>30 min</th>
<th>1 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>0.49(0.29)</td>
<td>0.26(0.13)</td>
</tr>
<tr>
<td>Liver</td>
<td>86.62 (1.30)</td>
<td>90.42 (0.52)</td>
</tr>
<tr>
<td>Spleen</td>
<td>2.00 (0.80)</td>
<td>1.69 (0.65)</td>
</tr>
<tr>
<td>Marrow</td>
<td>0.80 (0.36)</td>
<td>0.81 (0.26)</td>
</tr>
<tr>
<td>Lungs</td>
<td>0.55 (0.29)</td>
<td>0.61 (0.40)</td>
</tr>
<tr>
<td>Kidneys</td>
<td>0.31 (0.25)</td>
<td>0.16 (0.12)</td>
</tr>
<tr>
<td>Bone</td>
<td>0.88 (0.54)</td>
<td>0.49 (0.31)</td>
</tr>
<tr>
<td>Stomach</td>
<td>0.05 (0.01)</td>
<td>0.14 (0.10)</td>
</tr>
<tr>
<td>Colon</td>
<td>0.01 (0.01)</td>
<td>0.01 (0.01)</td>
</tr>
<tr>
<td>Ovaries</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Lymph nodes</td>
<td>0.04 (0.02)</td>
<td>0.03 (0.02)</td>
</tr>
<tr>
<td>Heart</td>
<td>0.02 (0.01)</td>
<td>0.01 (0.01)</td>
</tr>
<tr>
<td>Bladder</td>
<td>0.04 (0.03)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Thyroid</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

*% injected dose/whole organ (mean and s.d. for six animals).

The distribution of radioactivity at 1 hr in the other RE organs studied was as follows: liver uptake of Tc-Sb-44 was 74.6%, and that of Tc-SC was 90.4%; spleen uptake of Tc-Sb-44 was 6.3% and that of Tc-SC was 1.7%. Uptake of Tc-Sb-360 in the rat spleen was shown to be 14.9%, which is 2.4 times Tc-Sb-44. This finding contrasts with imaging studies in the rabbit (Fig. 4), where splenic uptake of Tc-Sb-360 was seen to be very much lower than that of Tc-Sb-44.

Blood clearance of Tc-SbC was slower than clearance of Tc-SC in the rat. The monitoring of blood clearance in cannulated rats revealed that 90% clearance of in-

### TABLE 2. RAT TISSUE DISTRIBUTION OF Tc-99m ANTIMONY COLLOID* FOLLOWING INTRAVENOUS ADMINISTRATION

<table>
<thead>
<tr>
<th>Tissue</th>
<th>10 min</th>
<th>30 min</th>
<th>1 hr</th>
<th>2 hr</th>
<th>4 hr</th>
<th>24 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>21.77 (9.11)</td>
<td>9.30 (2.14)</td>
<td>7.34 (1.23)</td>
<td>4.86 (1.02)</td>
<td>5.35 (1.16)</td>
<td>1.98 (0.89)</td>
</tr>
<tr>
<td>Liver</td>
<td>54.26 (5.49)</td>
<td>68.75 (1.42)</td>
<td>74.56 (2.86)</td>
<td>75.12 (2.86)</td>
<td>74.23 (3.05)</td>
<td>77.33 (2.16)</td>
</tr>
<tr>
<td>Spleen</td>
<td>7.30 (2.29)</td>
<td>7.13 (1.60)</td>
<td>6.30 (1.64)</td>
<td>7.10 (1.50)</td>
<td>7.77 (1.38)</td>
<td>5.85 (1.09)</td>
</tr>
<tr>
<td>Marrow</td>
<td>2.70 (0.76)</td>
<td>2.60 (0.94)</td>
<td>2.54 (0.42)</td>
<td>2.90 (0.89)</td>
<td>3.54 (0.66)</td>
<td>2.48 (0.43)</td>
</tr>
<tr>
<td>Lungs</td>
<td>0.71 (0.31)</td>
<td>0.49 (0.28)</td>
<td>0.57 (0.38)</td>
<td>0.21 (0.03)</td>
<td>0.32 (0.10)</td>
<td>0.36 (0.29)</td>
</tr>
<tr>
<td>Kidneys</td>
<td>0.46 (0.16)</td>
<td>0.34 (0.05)</td>
<td>0.33 (0.08)</td>
<td>0.33 (0.08)</td>
<td>0.55 (0.16)</td>
<td>2.54 (1.55)</td>
</tr>
<tr>
<td>Bone</td>
<td>0.76 (0.15)</td>
<td>1.42 (0.46)</td>
<td>0.88 (0.53)</td>
<td>1.00 (0.38)</td>
<td>1.33 (0.34)</td>
<td>0.95 (0.26)</td>
</tr>
<tr>
<td>Stomach</td>
<td>0.14 (0.03)</td>
<td>0.10 (0.06)</td>
<td>0.23 (0.09)</td>
<td>0.14 (0.07)</td>
<td>0.12 (0.05)</td>
<td>0.09 (0.05)</td>
</tr>
<tr>
<td>Colon</td>
<td>0.02 (0.01)</td>
<td>0.02 (0.01)</td>
<td>0.02 (0.01)</td>
<td>0.02 (0.01)</td>
<td>0.08 (0.05)</td>
<td>0.25 (0.14)</td>
</tr>
<tr>
<td>Ovaries</td>
<td>0.05 (0.02)</td>
<td>0.05 (0.02)</td>
<td>0.05 (0.02)</td>
<td>0.03 (0.01)</td>
<td>0.03 (0.01)</td>
<td>0.04 (0.01)</td>
</tr>
<tr>
<td>Lymph nodes</td>
<td>0.06 (0.02)</td>
<td>0.09 (0.03)</td>
<td>0.08 (0.02)</td>
<td>0.10 (0.04)</td>
<td>0.07 (0.01)</td>
<td>0.07 (0.03)</td>
</tr>
<tr>
<td>Heart</td>
<td>0.18 (0.12)</td>
<td>0.09 (0.03)</td>
<td>0.07 (0.02)</td>
<td>0.06 (0.01)</td>
<td>0.05 (0.02)</td>
<td>0.03 (0.01)</td>
</tr>
<tr>
<td>Bladder</td>
<td>0.02 (0.01)</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
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<td>Thyroid</td>
<td>&lt;0.01</td>
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<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

*% injected dose/whole organ (mean and s.d. for six animals).
jected Tc-Sb-44 and Tc-Sb-360 required 40 and 75 min, respectively, while 90% clearance of Tc-SC was achieved in 3 min. (See also Tables 1 and 2.)

The distribution of Tc-SbC activity in other organs of the rat was as follows. Uptake in the lungs was maximal (0.71%) 10 min after injection and fell to a minimum of 0.21% at 2 hr. Uptake in the kidneys fell to 0.33% at 2 hr and increased again to 2.54% at 24 hr, which may be attributed to metabolic breakdown and excretion of the radiocolloid. Small amounts of Tc-99m from both Tc-SbC and Tc-SC were found in the thyroid and stomach, consistent with the low activity of free pertechnetate (<5% for Tc-Sb-44 and Tc-Sb-360 preparations and <2% for Tc-SC) demonstrated on in vitro chromatography. Labeling efficiency of Tc-Sb-W was 90%.

Electron microscopy of bone marrow. The colloid Tc-Sb-44 was readily detectable in specimens of bone marrow as particulate electron-dense material measuring 4–6 nm in diameter (Fig. 6). Only occasionally was the radiocolloid found in the endothelial cells lining the bone-marrow sinusoids, and in these few instances it was confined to lysosomal dense bodies. Most of the electron-dense material was seen within the subendothelial resident dendritic mononuclear phagocytes of the bone marrow (Fig. 6), but not in any of the extrasinusoidal leukocytic phagocytes or their precursors.

Generally the particulate material was present within the lysosomes or phagosomes of the dendritic phagocytes (Fig. 6). In a few instances the phagosomes were much distorted by the presence of elongated, slightly osmiophilic, crystalloid material that was enclosed with the other phagosomal contents (Fig. 7). Occasionally pseudopod-like extensions from the subsinusoidal phagocytes protruded between the lining endothelial cells into the sinusoidal lumen (Fig. 6).

DISCUSSION

Technetium-99m antimony colloid is clearly superior to Tc-99m sulfur colloid for bone-marrow imaging in rabbits. This superiority may be attributable to the small size, charge, or other physical characteristic of the colloid particle.

The role of particle charge in influencing RE distribution of radiocolloids was not investigated in this study. Measurement of such charge may be performed in vitro but the definitive determination must be made in vivo to assess the effect of interaction with plasma proteins and opsonins (1). Polyvinylpyrrolidone may also influence the charge on Tc-SbC particles and contribute to the observed changes in splenic uptake in rabbits.

Particle size and activity distribution of Tc-99m sulfur colloid have been determined by various techniques (12–15), all of which show that most sulfur colloid...
Particles exceed 100 nm in diameter and are spread over a wide size range. In contrast, the particle size of Tc-99m antimony colloid occupies a narrow range less than 15 nm in diameter.

Warbick et al. (12) used electron-microscopic analysis to measure particle size distribution of their Tc-99m antimony colloid preparation, and determined a mean diameter of 10 nm with a range of 3–18 nm. In our laboratory direct manual measurement of particle size from electron micrographs of Tc-99m antimony colloid, prepared according to the method of Warbick, gave values of 6 nm diameter with a range of 1–13 nm. This discrepancy is unlikely to be due to the small difference in molecular weight of the stabilizer, and may be attributable to the use of an image-analysis computer by Warbick et al. We have shown that there is little overall difference in the particle size distributions of these two Tc-99m antimony colloid preparations.

Preliminary investigations indicated that the distribution of particle dimensions was similar in negatively stained and unstained preparations. It was assumed that these particles represented the smallest insoluble units of the colloidal preparations, although the degree of their modification by the preparatory ultrastructural techniques could not be assessed.

Methods employing gel filtration and nuclo pore filtration (16, 17) have been used to determine particle size of radiocolloids, but electron microscopy is acknowledged to be the most definitive method of assessing colloidal particle size. Although the EM analysis does not relate particle size to the distribution of radioactivity, the very narrow size range of Tc-99m antimony colloid particles makes it likely that the distribution of these particles on an electron micrograph also represents the distribution of activity.

Polyvinylpyrrolidone of mol. wt. 44,000 appears to be better than PVP of mol. wt. 360,000 for stabilizing the colloid. Blood clearance of the latter material takes longer and the size distribution of its particles is less well-defined. Polyvinylpyrrolidone of mol. wt. 10,000 was found to be totally unsatisfactory for stabilization of Tc-SbC because precipitation occurs under the heating conditions required for labeling.

Heating of the colloid by autoclaving is a more rapid and convenient method of labeling than is the 30 min boiling water bath, and the former also increases labeling efficiency. In addition, clearance of activity from rabbit kidneys is more rapid after injection of the autoclaved antimony colloid.

It is interesting that Tc-99m antimony colloid concentrates in the subendothelial dendritic phagocytes of the bone marrow. The actual route of access of these cells is at present unclear. It may be that the radiocolloid is transported by micropinocytosis across the endothelial lining of the sinusoid before it can be endocytosed by the phagocytes. If that is the case, the necessity for colloid particles to be smaller than the micropinocytic vessels (10 nm) becomes evident. Alternatively, the particles may pass through the junctions between adjoining endothelial cells or be captured by pseudopods from the subendothelial phagocytes protruding through the interendothelial junctions into the sinusoidal lumen.

Only the dendritic cells concentrate the Tc-99m antimony colloid, and endocytosis by erythrophoietic and leukopoietic precursors does not occur. The material concentrates within lysosomes and phagosomes. The nature of the elongated crystalloid in the latter is unclear but it may reflect the accumulation of some component of the colloid within these organelles.

The bone-marrow phagocyte is very susceptible to

FIG. 7. Electron micrograph of mononuclear phagocyte in rabbit bone marrow displaying a large phagosome enclosing particulate electron-dense material of Tc-99m antimony colloid as well as some crystalloid material. Original magnification 16,500.
ischemic insult (18) and rapidly loses the ability to concentrate radiocolloid after interruption of blood supply. This susceptibility is the basis for the use of Tc-99m antimony colloid in our laboratory to image bone marrow within 24 hr of subcapital fracture of the femur for preoperative assessment of femoral-head vascularity (19).

FOOTNOTES

* Na3H PO4·7H2O, 93 mg/ml; NaH2 PO4·H2O, 5.4 mg/ml.
† Citric acid 20.2 mg/ml, sodium hydroxide 14.5 mg/ml.
‡ ITLC Type SG medium, Gelman Inst. Co., Ann Arbor, MI.
§ Alfathesin–Glaxo Australia Pty. Ltd.

REFERENCES


WINTER WEEKEND MEETING
SOUTHERN CALIFORNIA CHAPTER
SOCIETY OF NUCLEAR MEDICINE

February 27–March 1, 1981
Balboa Bay Beach Club
Newport Beach, California

Announcement

The Southern California Chapter will hold a special weekend meeting at the Balboa Bay Beach Club in Newport Beach. The program will begin with a reception and dinner followed by a "layman-type" lecture on Friday evening. Dr. Moses Greenfield will give his delightful presentation on the "Instrumentation of Medical Quackery." Saturday morning, February 28, will be dedicated to Chapter business and a symposium with several invited speakers. Plans for the remainder of the weekend include a cocktail cruise on Balboa Bay, tennis, golf and other delightfully relaxing extracurricular activities. It is hoped that this low-keyed, nerve-soothing format for a local meeting will create an atmosphere in which one might get to know their colleagues a little better, and perhaps be a little more conducive to sharing ideas than is possible during one of the conventional Chapter dinner meetings. Plan to be there. Look for future announcements.

Dr. Jerome Gambino is Program Chairman for this meeting. This is an approved program for Category I CMA CME Credit.

For further information and registration please write or call: Jean Parker, Administrator, P.O. Box 40279, San Francisco, CA 94140 (415) 647-0722 or 647-1668.