Case Report: Clotting of Tc-99m-Labeled Red Blood Cells

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In-vivo labeling of red blood cells (RBCs) with Tc-99m for multigated cardiac blood pool imaging has been widely used since its introduction in the late 1970s (1,2). Although, in general, the results with the in-vivo labeling technique are excellent, in occasional patients RBC labeling may be inadequate and image quality unsatisfactory. Recently, a modification of in-vivo labeling has been proposed (3,4). This technique involves the injection of stannous pyrophosphate followed by incubation of a small volume of the patient's blood in a syringe containing [99mTc] pertechnetate. We report an interesting observation directly related to this modification and stress the importance of thorough heparinization.

Case Report

The patient was a 27-year-old man with carcinoma of the prostate referred to nuclear medicine for a routine gated blood pool study to assess left ventricular function for possible treatment with chemotherapy. He was one of the first patients in whom we used the modified technique for routine multigated cardiac blood pool imaging.

Fifteen minutes after intravenous injection of unlabeled stannous pyrophosphate (12 mg), an 18-gauge polyethylene catheter was placed in a large anticubital vein. A 3-in. heparinized extension tube with a three-way stopcock at the end was attached to the catheter. Subsequently, 1 ml of blood was withdrawn through the heparinized tubing into a syringe that contained 25 mCi (0.5 ml) of [99mTc] pertechnetate and was connected to the stopcock. The blood was incubated at room temperature in the syringe for 10 min, inverted frequently to maximize mixing, and then reintroduced in the tubing. The radioactive blood was injected as a rapid bolus, using 20 ml of normal saline as flush, for multigated first-pass radionuclide ventriculography to assess function of the right ventricle in the right anterior oblique (RAO) position. Thereafter, multigated equilibrium cardiac blood pool ventriculography was performed in the anterior, left anterior oblique (LAO), and left lateral views. Figure 1 shows the end-diastolic and end-systolic frames in four views. The low background activity indicates good RBC labeling. The right ventricle is normal in size and contractility. The left ventricle was slightly enlarged and shows good global contractility with some inferior wall akinesis [Fig. 1(D)].

The most remarkable findings are areas of intense activity (arrows) in the right ventricle (already present during the first-pass study but also seen on the equilibrium study). In Fig. 1 (D), the focal area of activity seems to have progressed into the lungs (arrows). The patient did not experience any adverse effects during rapid bolus injection, or during the hours after imaging. The areas of localized intense activity on the initial study (Fig. 1) were believed to represent small clots of Tc-99m labeled red cells trapped initially in the right ventricle and later in the lungs.

FIG. 1. Initial multigated cardiac blood pool study without heparinization of syringe containing Tc-99m. The end-diastolic (ED) and end-systolic (ES) frames are shown. (A). Multigated first-pass study of the right ventricle in right anterior oblique position. Multigated equilibrium blood pool studies in anterior (B), left anterior oblique (C), and left lateral (D) positions. Arrows indicate areas with intense Tc-99m activity representing small clot of Tc-99m labeled red cells trapped initially in the right ventricle and later in the lungs.

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are identical; however, no localized areas of increased radioactivity are present.

Apparently, during incubation in the syringe, small aggregates of Tc-99m labeled RBCs were formed. This explains the intense specific radioactivity and distribution in right heart and lungs. The clots must have been very small because the patient did not have any hemodynamic symptoms or consequences. The formation of red cell clots in the syringe occurred in spite of frequent inversion of the syringe. Although the entire tubing system was heparinized, the syringe containing Tc-99m was not. Clearly drawing blood through heparin solution into a non-heparinized syringe was not sufficient to prevent clotting. We now thoroughly heparinize all parts of the tubing system, including the syringe, into which Tc-99m is drawn, and we have not encountered this phenomenon again.

References