

Imaging

In Vivo Labeled Red Cells in the Detection of Pericardial Effusion

K.W. Kemper

St. Joseph Hospital, Kirkwood, Missouri

Diagnosis of pericardial effusion can sometimes be difficult. We have devised a simple, fast, and effective method for diagnosis of pericardial effusion.

Pericardial effusion is an increased accumulation of fluid in the pericardial sac. Diagnosis is primarily made with a chest x-ray and echocardiography. In cases where studies are equivocal or the equipment is unavailable, the nuclear medicine department is often asked for assistance (1-3).

We have developed a simple method of diagnosing pericardial effusion. We use a gamma camera, a technetium flood field, and in vivo labeled red blood cells (4,5).

Instrumentation

A Searle large field-of-view gamma camera with a low energy, parallel hole collimator is used. Films are taken on a Searle Micro Dot imager with an intensity of 0.35 (low). Micro Dot multifORMAT imager is adjusted to multi-image (large). Images are obtained on Kodak 8 × 10 single emulsion nuclear medicine film. For departments without a large field camera, a standard field camera with a diverging collimator will produce comparable images.

In Vivo Labeling Technique

One vial of lyophilized pyrophosphate containing 12 mg of stannous pyrophosphate (Mallinckrodt) is reconstituted with 3 ml of bacteriostat-free low-dissolved oxygen saline (Syncor). Slight agitation is performed to insure complete cold labeling. After 5 min the solution is ready for use.

Material and Methods

A flood field containing 30 mCi of Tc-99m in 2 liter of

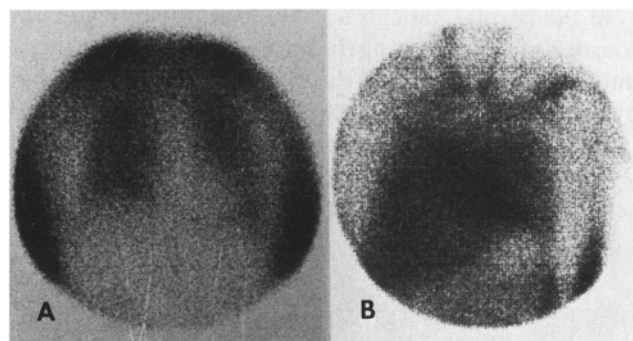


Fig. 1. (A) Transmission image of patient; (B) Transmission and in vivo labeled red blood cell image of normal patient.

water is used as a transmission source to penetrate the lung fields. This eliminates the need to use radiotracer to produce activity in the lungs. A transmission source gives a uniform background density throughout the lungs. Radiation exposure to the patient is reduced since the source of radiation is removed at the end of the procedure. This eliminates the possibility of reaction to the albumin particles, which is a concern in pulmonary venous hypertension. The patient is positioned supine on the transmission source so that the entire chest and upper abdomen are encompassed. The patient (still on the source) is then positioned under the gamma camera and an anterior image is taken for 500 K counts. This image will show uniform radioactivity in the lung fields with decreased activity in the heart. Because the density of the blood in the myocardium and effusion in the pericardium is the same, a pericardial effusion cannot be distinguished with this film image.

The patient is now given straight intravenous injection of the "cold labeled" pyrophosphate. The pyrophosphate is allowed to tag to the red blood cells for 30 min. Following this, 15-mCi sodium pertechnetate is given via straight venipuncture of any acceptable vein and allowed to tag for 10 min.

A second anterior image is taken without repositioning the patient.

For reprints contact: K.W. Kemper, Nuclear Medicine, St. Joseph Hospital, 525 Couch Ave., Kirkwood, MO 63122.

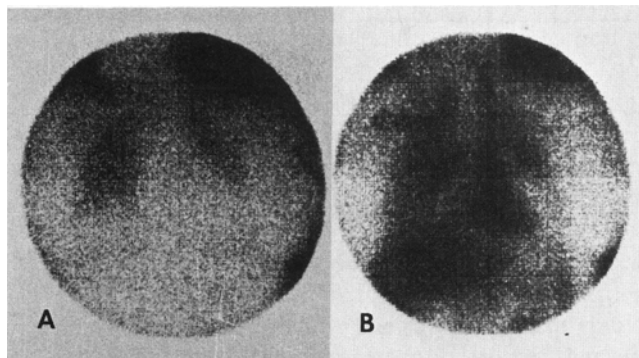


Fig. 2. (A) Transmission image of patient with pericardial effusion; (B) Pericardial effusion demonstrated with transmission source and in vivo labeled red cells.

Results

In the normal patient, activity from the transmission source is seen penetrating the lungs. This will fade directly into hepatic activity and the myocardial activity caused by the in vivo labeled red blood cells (Fig. 1).

In a patient with pericardial effusion the "halo effect" is seen (Fig. 2). The halo effect is a band of decreased activity around the myocardium. It is seen because the

fluid density of the pericardial effusion is avascular; therefore, no red blood cells have the opportunity to enter this compartment.

Acknowledgment

I wish to thank Barbara Bussard, Wallace Fuhrman, and Steve Templemeyer for their assistance in preparing this article.

References

1. Feigenbaum H. Echocardiography 1976. In *Pericardial Disease*, Philadelphia, Lea & Febiger, 1976: 419-27.
2. Holmes RA, Wagner HN. Delineation of Blood Pools. In *Principles of Nuclear Medicine*, Wagner HN, ed, Philadelphia, W.B. Saunders Co., 1968: 566-71.
3. DeLand FH, Wagner HN. Pericardial Effusion. In *Atlas of Nuclear Medicine*, vol 2, Lung and Heart, Philadelphia, W.B. Saunders Co., 1970: 266-72.
4. Pavel DG, Zimmer AM, Patterson VN. In vivo labeling of red blood cells with ^{99m}Tc : A new approach to blood pool visualization. *J Nucl Med* 1977; 18: 305-08.
5. Hamilton RG, Alderson PO. A comparative evaluation of techniques of rapid and efficient in vivo labeling of red blood cells with ^{99m}Tc pertechnetate. *J Nucl Med* 1977; 18: 1010-13.