Detection of Left Atrial Myxoma by Radionuclide Cardiac Imaging

— A Case Report —

Tamotsu Osawa, M.D.

Department of Radiology, Ken-seibu Hamamatsu Medical Center Hospital

Kazutoshi Hirose, M.D.

Department of Radiology, Ken-seibu Hamamatsu Medical Center Hospital

Satoshi Sawada, M.D.

Department of Radiology, Kansai Medical University

Hiroshi Hamada, M.D.

Department of Radiology, Higashiosaka Shiritsu Chuo Hospital

ABSTRACT

Primary cardiac neoplasms are extremely rare. Recently, it was noted in several reports that the radionuclide angiocardigraphy was particularly evaluated for the diagnosis of intracardiac tumors. In this paper, a case of left atrial myxoma diagnosed by the radionuclide angiocardigraphy was presented, which was surgically treated with success.

INTRODUCTION

Primary cardiac neoplasms have rarely been found, only in 0.0017-0.03% among unselected autopsy cases^{1) 2)}. The first case of left atrial myxoma detected with the scintiphotographic examination was reported by Kriss et al³⁾. Since then, Zaret, B.L. et al⁴⁾ described the use of radionuclide angiocardigraphy and ECG-gated scintiphotographic cardiac imaging and Pohost, G.M. et al⁵⁾ recognized on the gated radionuclide cardiac blood pool scans.

In this paper, the authors present a case of left atrial myxoma, of which in the diagnosis the radionuclide angiocardigraphy and cardiac pool scan played an important role. In this point of view, the significance of scintiphotography for diagnosis of cardiac tumors will be discussed, reviewing the references of cardiac tumors detected by scintiphotographic manifestations.

CASE REPORT

A 55-year-old man having no history of rheumatic disease previously, was admitted

to the Kenseibu Hamamatsu Medical Center Hospital (KHMCH) on July 10, 1976.

He had been in good health until dyspnea appeared by physical exercise on February, 1976. As dyspnea had increased gradually, the patient admitted to a private hospital under the diagnosis of congestive heart failure due to primary myocardial disease but the pharmacomedical treatment was of little benefit. Then he was referred to the cardiac department of KHMCH for the purpose of precise examination for cardiac murmur and abnormal electrocardiogram.

Past history was noncontributory, history of diabetes mellitus and hypertension were known in his family.

Physical examination revealed that he was a moderately developed old man having blood pressure of 100/70mmHg and regular pulse rate at 66/min.

Distended juglar veins and moderately enlarged liver without ascites were noted, and there was no ankle edema. Auscultation at the apex revealed a loud first sound and soft systolic murmur. An opening snap was present after the second sound and was followed by a short mid-diastolic murmur. The chest was clear to auscultation.

Laboratory examinations showed a red blood cell count of 4.59 million and white blood cell count of 8,600 per cubic millimeter, with a hematocrit of 43.1 per cent and a hemoglobin content of 15.0g per 100ml of blood. Blood sedimentation rate was 12mm per hour.

Liver function tests, serum electrolytes and enzymes, including GOT, GPT, LDH and CPK, were all within normal limits.

The chest roentgenogram revealed slight cardiomegaly with prominence of the pulmonary arteries and veins. Lung fields were almost normal except septal lines in the left basal field (**Fig. 1**).

The electrocardiogram demonstrated normal sinus rhythm, left atrial enlargement, counter-clockwise rotation, suggesting right ventricular hypertrophy, and non-specific ST-T changes. The echocardiogram showed a large cloud of wavy-lined echoes seen posterior to the anterior leaflet of the mitral valve in the left ventricle during diastole and left atrium during ventricular systole.

The phonocardiogram showed prolonged interval between Q wave and the first sound, loud accentuation of the first sound, and diastolic rumbling with click "tumor plop". The apexcardiogram revealed downward retraction during systole and outward movement corresponding to the tumor plop sound during diastole.

Following the intravenous bolus injection of ^{99m}Tc human serum albumin (^{99m}Tc -HSA), left atrial myxoma was detected by both radionuclide angiocardigraphy and

Fig. 3. Cardiac blood pool scanning : 30 minutes after injection of nuclide, there is a huge filling defect in the left atrium adjacent to the mitral valve (arrows). RA = right atrium, RV = right ventricle, mPA = main pulmonary artery, LA = left atrium, LV = left ventricle, asc Ao = ascending aorta.

Fig. 4. Unprocessed (A) and computer processed (B) radionuclide angiocardigram. A filling defect (see arrows) is poorly defined in the region of the left atrium in the unprocessed images on the upside. This defect (see arrows) is clearly defined in the computer processed images on the underside. Onset of exposure in frames after injection for each 0.2 second is indicated. LA = left atrium, LV = left ventricle, Ao = ascending aorta.

cardiac blood pool scanning (**Fig. 2, 3, 4**).

The findings of the cardiac catheterization are summarized in Table 1.

Left atrial myxoma was demonstrated by the angiocardigraphy as well as a radionuclide angiocardigraphy. Angiocardigraphy demonstrated a huge filling defect which showed the pendulum movement between left atrium and left ventricle simultaneously to the cardiac movement (**Fig. 5**).

Surgery was performed on September 1, 1976, and left atrial myxoma was completely removed under the condition of hypothermia and cardiopulmonary bypass method. Left atrial cavity was almost entirely filled with a large pedunculated tumor arising from the rim of fossa ovalis in the left atrial septum (**Fig. 6**).

Table 1. Summary of cardiac catheterization data

Location	Pressure (mmHg)		% Oxygen saturation
	Mean	Systolic/Diastolic	
Superior vena cava			14.9
Right atrium	8	8.8 / 4.8	14.4
Right ventricle	30	59 /	14.0
Main pulmonary artery	42	60 / 32	14.9
Pulmonary capillary wedge	35	a 40 v 52 x 32 y 22	14.9

Fig. 5. Angiocardiogram shows a huge filling defect which traveled from the left atrium to the left ventricle according to the cardiac movement.

- A. Diastole. A large filling defect in the left ventricle is seen (arrows).
- B. Systole. There is a large filling defect in the left atrium (arrows).

Fig. 6. Removed surgical specimen. Tumor stalk is seen in lower portion. A mass measuring approximately 5×5×3cm.

In addition, the mitral valve and right atrium were normal. Histologically, the gelatinous, semitransparent, light-yellowish tumor of left atrium was proved to be a typical myxoma. The postoperative course has been uncomplicated.

SCINTIPHOTOGRAPHIC TECHNIQUE

Our method of intravenous radioisotopic angiocardiology is as follows.

In order to obtain a good bolus of radionuclide, three way stopcock method is used (**Fig. 7**).

Teflon needle of 19 Gage caliber connected by three way stopcock to the ^{99m}Tc -HSA and saline syringe is

Fig. 7. Schematic representation of a simple injector system for three way stopcock method.

inserted into the right femoral vein. $^{99m}\text{Tc-HSA}$, 20mCi in 1ml saline, is rapidly injected and then the vein is flushed with 20ml of saline immediately. After the injection of the radionuclide in supine position, the series of cardiac scintiphotograms are taken with 30° left anterior oblique projection using Toshiba Scintillation Camera GCA-202 fitted with 20,000 parallel hole high resolution low energy collimator.

The scintillation camera is connected to 32KB minicomputer (TOSBAC-40C) with 4.8 MB disc. The counts from the camera are fed into core memory of TOSBAC-40C with list mode data acquisition format through two analog-digital converters.

Moreover, images are obtained for 300msec at a rate of 1/sec with a 35mm time lapse camera equipped with a motor-driving film transport.

The cardiac blood pool scanning is started from 10 minutes after radionuclide injection using a TOSHIBA Scintillation Camera GCA-202 and a TOSHIBA dual 5 inch unit. Heart pool scan is performed with scintillation camera in various views especially with 30° left anterior oblique view.

RESULT

Left anterior oblique view was best position to visualize the left atrial myxoma.

Our three way stopcock method using right femoral vein obtained a good bolus of radionuclide.

Computer handling of radionuclide angiocardiographic data was useful in the diagnosis of left atrial myxoma.

In the radionuclide angiocardiogram and heart blood pool scanning, a huge filling defect in the left atrium adjacent to mitral valve was seen (Fig. 2, 3, 4).

The position of the cardiac chambers and great vessels was normal.

The right to left shunt and left to right shunt were not seen. The results were confirmed by findings of cardiac surgery.

DISCUSSION

Since the first studies in this field were performed by Bender et al in 1963⁸⁾, there

has been steady improvement in technique⁷⁾⁻⁹⁾. Then, many investigators have performed radionuclide angiocardiology so that the findings under various cardiac conditions have been described¹⁰⁾⁻¹²⁾.

Right atrial myxoma has been previously demonstrated by radioisotopic procedure^{3), 13)-15)}. Staub¹⁶⁾ detected metastatic tumor of the right atrium with renal cell carcinoma using radionuclide angiocardiology. It may be easier to detect tumors of right atrium since there will be the least superimposed activity from other structures along the lower right heart border.

Using radionuclide angiocardiology Steiner, et al¹⁷⁾ have also recently demonstrated the presence of right ventricular metastasis from colon cancer.

Although the radionuclide angiocardiology usually does not define anatomic detail compared with selective contrast angiocardiology. The method has the obvious advantages of simplicity of performance, avoidance of hospitalization or cardiac catheterization, and avoidance of unfavourable pharmacologic reactions and the disturbance of cardiodynamic events. It also offers lower body radiation dose and allows frequently repeated examinations.

Before the injection of radionuclide, positioning of view must be selected. The most appreciate view to visualize the left atrium, in which there is no overlap of the four heart chambers, can be obtained with the patient in the left anterior oblique projection.

Radionuclide volume should be kept to a minimum to avoid spread of the bolus in the vein. So, the new injection system was used to keep this small volume of the material as a bolus (Fig. 7).

This system consists of a 19 Gage teflon needle which are attached three way stopcock connecting two syringes, a syringe containing radionuclide, and the other containing saline. The syringe has a metallic lock to keep a tight connection of syringe with three way stopcock. The disposable system is relatively simple and inexpensive.

The authors previously had been used right cubital vein, but nuclide remained in the right subclavian vein. Therefore, we have been made use right femoral vein for bolus injection of radionuclear angiocardiology. Injection from right femoral vein obtains good bolus in comparison with injection from right cubital vein.

The recording is initiated simultaneously with the injection of the radionuclide. Recording time is 30 seconds.

^{99m}Tc-HSA is the radiopharmaceutical of choice for cardiac blood-pool studies because of the superior spatial resolution afforded by the 140 kev rays and the maintenance of

sufficiently high blood levels during the scanning or imaging period.

Radionuclide angiocardiology can be done with a gamma camera and a 35mm time lapse camera equipped with a motor-driving film transport alone, but diagnostic information can be increased when data-handling equipment is available.

Concerning to record the cardiac images, a 35mm camera with an automatic film advance mechanism may be used. However, this mechanism has a "dead-time" when the film advances (approx 600msec), during this time no data can be recorded and this means that composite images of different flow phases may be missed.

Quantitative nuclear angiocardiology obtained by interfacing the camera with a digital computer allows to analyse quantitative and morphological changes. Small dedicated digital computers facilitate the analysis of the data, i.e., smoothing, uniformity, correction, image subtraction, histogram generation, etc.

Computer handling of radionuclide angiocardigraphic data may be useful in the diagnosis of left atrial myxoma. Note that the filling defect is well defined in the region of the left atrium in the computer processed image, but a defect is ill defined in the unprocessed image (Fig. 4).

Recently, the diagnosis of left atrial myxoma has been greatly facilitated by echocardiography^{18) 19)}. However, it is occasionally difficult or impossible to obtain an adequate echocardiogram and the echocardiogram may not always be diagnostic tool of left atrial tumor and many false negatives have been encountered²⁰⁾.

SUMMARY

The authors presented a case of a left atrial myxoma diagnosed by scintiphotographic examination and emphasize that both radionuclide angiocardiology and heart blood pool scan are simple, effective and non-invasive procedure which are very useful as a screening test in the cases that the existence of a cardiac tumor is suspected.

Computed radionuclide angiocardiology may be used in such cases as congestive heart failure, pulmonary hypertension, and either mitral or tricuspid stenosis and it may be also utilized in the cases of unusual cardiomegaly in the chest roentgenograms, unusual heart murmur, arrhythmia and cardiac pain is noticed independently or not.

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