holes collimator, the data were transferred to the radioisotope data processing system (JAC-120M) and recorded on magnetic tape. Soon after injection of ^{201}Tl (2 mCi), serial images were taken 60 frames (one frame = one second). And 2 or 3 minutes after injection, serial images were taken 30 frames (one frame = 20 seconds). Static images of several projection such as anterior ivew, left anterior oblique 30, left anterior oblique 45, left lateral view, right anterior oblique view 30, and anterior view were taken one another after.

Early images were observed for flow of right ventricle, second serial images for the uptake curve of the myocardial wall and the decreased curve of the lung.

ROI of myocardium, lung and cavity of left ventricle were measured to set on early (after 20 min.) and late (after 60–80 min.) images of anterior view, using radioisotope data processing system. Ratio of myocardium to the lung (1) and myocardium to the cavity of left ventricle (2) were calculated as follows

	20 min.	60–80 min.
(1)	2.0 –2.76(2.37)	2.2 –3.3 (2.75)
(2)	1.04–1.38(1,21)	1.04–1.64(1,24)

( ) = mean value

The results showed that we can obtain good myocardial images within 60–80 minutes after injection.

Comparison of ^{201}Tl Myocardial Imaging with Vectorcardiogram and ^{99m}Tc Angiogram

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^{201}Tl myocardial imaging, Vectorcardiogram and ^{99m}Tc angiogram were performed in 34 patients (25 patients with myocardial infarction and 9 controls). Findings of three methods well agreed with each other, but some discrepancies were found. Septal myocardial infarction was more frequently diagnosed by Vectorcardiogram than by ^{201}Tl myocardial imaging. Patients with inferior myocardial infarction diagnosed by Vectorcardiogram had cold image of ^{201}Tl myocardial imaging at anterioinferior or posteroinferior region of myocardial image, but 2 patients with anterioinferior cold image had not inferior infarction pattern in Vectorcardiogram. Asynergy in ^{99m}Tc angiogram was useful for indirect evidence of existing of myocardial infarction.

Analysis of Radioisotopic Dilution Curve by Non-linear filter

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Recently, utilization of mini-computer for processing dynamic radionuclide data such as identification of turn over rate of the tracer and construction of parametric image has become popular. Since the data are obtained from random decays of radionuclides, they includes noise inevitably, and are also contaminated by background or recirculation.

Extended Kalman filter was applied to radioisotopic dilution curve analysis of the first order system, considering input noise and observation noise, and compared with conventional analysis.

Computer simulation of the first order system including Poissonian noise was performed, and time constant was also identified for the radionuclide dilution curve which was obtained from phantom model. The identified parameters by this filter yielded good results compared with least square fitting method. In addition, the variances of the calculated parameters simultaneously obtained by this filter were reasonable and decreased rapidly in the early phase of the dilution curve.

This filter was also applied clinically to the dilution curve of the right heart and to the initial transit curve of the kidney, assuming that they are first order system. In both cases, the time constant and its variance were obtained utilizing the early phase of the dilution curve.

The extended Kalman filter was valuable to determine the time constant and its variance of the first order system, utilizing the initial sequence of the dilution curve with less contamination rapidly.

Transfer Function Analysis of Circulatory System Based on Iterative Deconvolution Method in Radionuclide Angiocardiography

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The purpose of this study is to investigate the computation of transfer functions of the cardiovascular system by means of the iterative deconvolution method, its applications to hemodynamic analysis and image reconstruction with these transfer functions in radionuclide angiocardiography.

The joint camera-computer system used in these studies consists of the GCA-202 gamma camera and the DAP-5000N computer system. Following intravenous injection of about 10 mCi of ^{99m}Tc-pertechnetate, 0.2–0.6 second frames of data in 64×64 matrix form were acquired for a period of 30 seconds utilizing the computer system.

Iterative deconvolution is described as follows,

The first iteration:

$$f^{(1)}(t)=f_0(t)+[(f_0(t)-\int R(k)f_0(t-k)\,dk$$

The nth iteration:

$$f^{(n)}(t)=f^{(n-1)}+[f_0(t)-\int R(k)f^{(n-1)}(t-k)\,dk \qquad (1)$$

Where $R(t)$ is $f_i(t)/\sum f_i(k)$, $f_i(t)$ is an observed input and $f_0(t)$ is an observed output.

The accuracy of a transfer function obtained by eq. 1 was estimated from the value of the correlation coefficient relating the observed output and the computed output by covolution integral (eq. 2).

$$f\mathrm{co}(t)=\int_{t=0}^{\infty} R(k)f_h(t-k)\,dk \qquad (2)$$

Where f_h is the transfer function and f_{co} is the computed output. In 30 cases, the mean value of the correlation coefficients between the observed output and the computed one was 0.9994.

In one of applications of the transfer function, estimation of Qp/Qs ratios in patients with left to right shunt using the transfer function between the MPA and the lung showed good correlation with oximetric determined Qp/Qs ratios (0.963).

Sequential dynamic images reconstructed by transfer functions visualized left atrial, left ventricular and aortic configurations with much better quality than originals.

In summary,

1) Accuracy of our iterative deconvolution method for the computation of the transfer function of a circulatory system was proved.
2) Estimation of Qp/Qs ratios by utilizing this method in patients with left to right shunt was highly reliable.
3) Image reconstruction with the values of thus obtained transfer functions showed exellent results.