systolic & diastolic relative volume velocities were compared in the cardiac diseases. The value of the maximum systolic volume velocity (MSVV) ranged 2.74 to 4.72/sec. with a mean value of 3.76/sec. and the value of the maximum diastolic volume velocity (MDVV) ranged 2.22 to 5.18/sec. with a mean value of 3.64/sec. in normal cases. In hyperthyroidism the values of MSVV were 4.46 & 4.6/sec., showing the upper limits of normal values, while the values of

MDVV were 5.55 & 5.5/sec., resulting in an increase. In myocardial infarction with & without CHF, the values of MSVV ranged 1.22 to 2.69/sec. with a mean value of 2.11/sec. showing decreased values, while the values of MDVV ranged 0.73 to 2.72/sec. with a mean value of 1.87/sec., sowing decreased values.

Three groups, normal, myocardial infarction & hyperthyroidism, could be separated better by this parameter than ejection fraction.

## Gated Myocardial Perfusion Scintigraphy

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High temporal resolution EKG gated analysis was performed for the study of left ventricular function. Four mCi of Thallium-201 Chloride was injected intravenously to visualize myocardium. Using 32 KW computer system and LIST mode data aquisition, sequential events during 10 to 50 msec. intervals are continuously recorded for 1500 to 2000 cardiac cycles. Besides 20 to 100 high temporal resolution sequential images of myocardial mass during a cardiac cycle, cyclic changes of muscle volume was obtained.

Thirty two cases including 6 normal control were examined. Gated myocardial perfusion image produced the sequential high temporal change of myocardial muscle volume during each cardiac cycle. By removing the cardiac motion, detection of the ischemic lesion became more clarified. Cyclic change of muscle volume was foumd to occur in the different grade when compared apex, free wall and septal wall. Asynchronous change of muscle contraction was clearly

noted in such cases as OMI and PMD.

Out of 32 $^{201}$Tl cardiac scan, right ventricle is hardly seen in 18 cases (56%), however 10 cases showed right ventricular accumulation and the rest of 4 cases showed remarkable accumulation indicating considerable thickning of the right ventricle. This 4 cases are consisted by 2 cases of COPP, 1 case of PMD, and OMI.

Out of 16 cases of old myocardial infarction (OMI), 11 cases showed defect in Tl scan indicating the presence of transmural infarction. EKG finding in these 16 cases correspond well in 10 cases. The rest of 6 cases showed discrepancy either due to false positive or false negative reading of EKG and recovery of ischemic region by collateral circulation without accompanying EKG change. Such analysis of left heart function when combined with gated pool scintigraphy have shown considerable promise in the daily diagnostic aid and investigational use.

## Clinical Experience of Myocardial Imaging Using $^{201}$Tl

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Scintigraphy of the myocardium using $^{201}$Tl was performed in 12 patients with myocardial infarction, in 6 patients with angina pectoris, and

in 3 patients with primary myocardiopathy.

Images were obtained with a gammacamera (GCA-102) using the high resolution 20000 parallel

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