decreased under hypoxia of N_2 and 10 % O_2 in N_2 and hypercarbia of 10 % CO_2 in air, while it increased under hyperoxia of 40 % O_2 in N_2, 60 % O_2 in N_2 and 100 % O_2. Regional perfusion responses of the denervated lung to various gases used in this study were similar to those observed in the normal lung. Even when the study was made at the maximal expansion of the RUL, the so-called TLC of the RUL, regional perfusion decreased under hypoxia and hypercarbia, while it increased under alveolar hyperoxia. Generally administered aminophylline did not affect regional perfusion.

In summary regional alveolar hypoxia, hypercarbia and hyperinflation induce regional pulmonary vasoconstriction, resulting in reduced regional perfusion, while regional alveolar hyperoxia induces regional pulmonary vasodilation and increases regional perfusion distribution. No nervous integrity is required for this vascular response.

High Resolution Analysis of Left Ventricular Functions

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Using γ-camera computer system, approximately 30 to 50 frames of images of left ventricular pool (^{99m}-Tc alb.) & left myocardium (201-T1C1) per cardiac cycle were acquisited at 20 msec interval by LIST mode. After digitized x-y scintillation coordinates and R-markers from the ECG were rerecorded on magnetic tape over 1500 to 2000 cardiac cycles, these data were sorted into a sequence of images.

Analysis of sequential cardiac pool & myocardial images gave; (1) contraction pattern, (2) relative volume curve, (3) ejection fraction, (4) relative volume velocity & (5) relative muscle volume.

(1) Contraction pattern of left ventricle was generated at 80 msec interval. Uniform contraction pattern was noted in normal control. However, in the case of myocardial infarction, the contraction pattern revealed distorted motion and asynergy corresponding to nonviable myocardium. Myocardial infarction associated with congestive heart failure was characterized by the enlargement of the cardiac pool.

(2) Relative volume curve of left ventricle was generated from change in counts of left ventricle after subtraction of background. Several dynamic parameters of left ventricular function were derived from this curve.

(3) Ejection fraction of normal left ventricle was 55 to 88 %. The myocardial infarction indicated 47 % in the mean ejection fraction. In the case of myocardial infarction associated with CHF, the ejection fraction decreased to 21 %. The ejection fraction of the mitral insufficiency was 57.6 %. After replacement of mitral valve, this value increased to 68.4 % which was within normal limits.

(4) Relative volume velocity of left ventricle was calculated by differentiation of the volume curve. The maximum values of the systolic & diastolic relative volume velocity were compared in cardiac diseases. In normal case the value of the maximum systolic volume velocity (MSVV) ranged 2.74 to 4.72/sec and the value of the maximum diastolic volume velocity (MDVV) ranged 2.22 to 5.2/sec. In hyperthyroidism the value of MSVV were 4.46 & 4.6/sec, showing the upper limits of normal values, while the value of MDVV were 5.55 & 5.5/sec, resulting in an increases. In myocardial infarction the value of MSVV and MDVV ranged 1.22 to 2.69/sec and 0.73 to 2.72/sec, respectively. Three groups, normal, myocardial infarction & hyperthyroidism, could be separated better by this parameter than ejection fraction.

(5) Relative muscle volume curve was generated from change in counts of three regions of interest, that is, free wall, apex and septum of left ventricular wall. The contraction fraction as an indicator of myocardial thickness was the ratio of the difference between the maximum & minimum muscle volume to the maximum muscle volume. The contraction fraction (CF) of hyperthyroidism was about 40 %, while CF of myocardial infarction & myocardosis was 20 %. The periods between R wave and the

maximum muscle volume were different in each area of left ventricular wall, free wall, apex & septum, in the myocardial infarction. On the other hand such an asynchrony was not observed in normal case.

In conclusion, non-traumatic analysis of detailed left ventricular functions showed good promise in the daily care of patients and, further, sophisticated analysis of cardiac funcion of the healthy and the diseased.

Myocardial Scintigraphy with 201-T1 and Quantitative Assessment of Myocardial Blood Flow

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A newly introduced radionuclide for myocardial imaging, 201-T1, is ideal for scintillation camera imaging of its proper energy, which is different in this respect from a series of potassium analog such as 43-K and 86-Rb. Since T1 moves into cells with high extraction efficiency from blood stream rapidly following an intravenous administration, distribution of this tracer represents blood flow distribution throughout the body like other potassium analogs. Ischemic regions, if present, can thus be shown as decreased uptake of 201-T1 or cold area. This paper presents (1) our experience of myocardial imaging with 201-T1 and (2) an attempt to quantify myocardial blood flow (MBF) with and without exercise loading.

46 subjects consisting of 11 normals, 17 with ischemic heart disease (IHD) including 14 with old myocardial infarction (MI), 6 with hypertrophic cardiomyopathy (HCM) and the remainder with various diseases. A bolus of 201-T1 as thallous chloride in 2.0 mCi were injected intravenously and its rapid transport through the central circulatory system and its subsequent process during initial 3 minutes were recorded by scintillation camera with diverging collimator so as to include whole chest and stored into direct playback system to be analyzed further. Then anterior (ANT), left anterior (LAO) and left lateral (1-LAT) myocardial ímaíng were studied using parallel hole high resolution collimator. 69–83 Kev of gamma spectrum was selected. Exercise loading was done using bícycle ergometer during 7–15 minutes of 100–300 watts/sec, simultaneously monitored by ECG.

Quantification of MBF was accomplished using the recording the rapid transport phase according to the indicator fractionation principles (Ishii et al, Cir Res 33: 113, 1973), as expressed in the following equation

$$MBF/CO = B/A$$

, where the fractional blood flow of the cardiac output (MBF/CO) is equated with the fraction of the myocardial activity (B) to the activity of total injected dosis (A) initially transit through the central circulatory system both in the term of the scintillation camera recording.

Normal myocardial scintigraphy revealed predominat visualization of left ventricular wall as well as septum, whereas in the case with right ventricular hypertrophy such as tetralogy of Fallot and cor pulmonale, right ventricular wall was well visualized. In 5 of 6 cases with HCM, asymmetric hypertrophy of myocardial mass was recognized. In 13 of 14 cases with established myocardial infarction, defects on scintigraphic image was recognized in the region well comformed with ECG findings. MBF/CO was calculated in all cases. Mean value of normals was 4.40 ± 0.52 %, that of IHD was 4.25 ± 0.82 % and of HCM was 5.80 ± 1.46 %. There was no significant difference between these groups. However, on exercise loading, MBF/CO increased in all normal cases, whereas no changes or decrease was observed in all cases with definite ST depression. These changes were found to be significant ($p < 0.1$).