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EVALUATION OF LV CONTRACTION AND RELAXATION ABNORMALITY IN THE PATIENTS WITH MI.

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In order to evaluate the regional contraction and relaxation abnormalities of LV, we performed Fourier approximation to regional volume curve using first and second harmonics and calculated multiple parameters as follows:amplitude(Amp),phase,regional ejection fraction(REF) & ejection time(RET), peak ejection rate(PER) & filling rate(PFR), peak ejection time(PET) & filling time(PFT). Detectability for abnormality of each parameter was compared in 30 cases with myocardial infarction(MI). All cases with MI had regional wall motion abnormality by LVG. In comparison on color functional images, conventional Amp & phase images showed no abnormality in 10 out of 30 cases with MI. However,by adding the new parameters all abnormalities were detected except one case. Mean values were calculated using Histogram. PER & PFR showed good correlation with LVEF, however,PET & PFT showed no significant correlation with LVEF. Decreased PER & PFR and delayed PFT were noted at the hypokinetic,akinetic and dyskinetic areas compared with the normokinetic areas.

Multi-parameter analysis was more useful to detect the wall motion abnormality than conventional Amp & phase analysis only.

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QUANTITATIVE EVALUATION OF POST-INFARCTION LEFT VENTRICULAR ANEURYSM BY PHASE ANALYSIS.

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For the more quantitative evaluation of post-infarction left ventricular (LV) aneurysm, temporal Fourier analysis using RI multigate pool image (MGPI) was attempted to 33 patients with and without post-infarction LV aneurysm and 7 with angina pectoris, RI MGPI was performed by equilibrium method at the LAO projection. The value of SD, as a fluctuation of phase was computed from the histogram of phase distribution by using temporal Fourier analysis.

Determination of ejection fraction (EF) using RI MGPI were correlative well ($r=0.82$, $p<0.01$) with measurements obtained by contrast LV cine-angiogram. The value of SD calculated from the histogram correlated with % perimetric circumference (ΔL) determined by contrast cine-angiogram ($r=0.81$,$p<0.01$). The value of SD in patients with massive LV aneurysm (over 35% of ΔL) showed high value (over 21 deg.). The patients accompanied by congestive heart failure (CHF) in their clinical course demonstrated higher value of SD than that of patients without CHF.

Thus, we concluded that the value of SD was considered as a usefull indicator for non-invasive quantitative evaluation in the cases with post-infarction aneurysm.

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QUANTITATIVE ANALYSIS OF REGIONAL LEFT VENTRICULAR WALL MOTION ABNORMALITY BY PHASE IMAGE: COMPARISON WITH ULTRASONIC CARDIOTOMOGRAPHY.

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Fourier analysis is a useful method to detect regional left ventricular(LV) wall motion abnormality(WMA). WMA was evaluated by LV contrast angiography and defined as follows; akinesis or dyskinesis(Group I), localized hypokinesis(Group II), and WMA(-) (Group III). Phase image and ultrasonic cardiotomography(UCT) were performed in 45 patients who comprised 21 in Group I, 10 in Group II, and 14 in Group III. In RAO phase image, LV was devided into apical, anterolateral, and inferior segments. When there is a difference in more than 15 degrees in the mean of pixel phase values(PV) within each segment, its image was evaluated as WMA. The sensitivity was 76% and 20% in Group I and II, respectively, and the specificity was 79% in Group III. In LAO phase image, when the standard deviation of PV within LV is more than 10 degrees, its image was evaluated as WMA. The sensitivity was 90% and 80% in Group I and II, respectively, and the specificity was 93% in Group III. In UCT, the sensitivity was 62% and 20% in Group I and II, respectively, and the specificity was 79% in Group III. In conclusion LAO and RAO phase images can detect the presence and site of WMA accurately.

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FOURIER ANALYSIS OF MULTI-GATED BLOOD-POOL DATA IN PATIENTS OF CONGENITAL HEART DISEASE WITH LEFT TO RIGHT SHUNT.

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The ventricular emptying performance in patients of congenital heart disease (CHD) with left to right (L-to-R) shunt was studied by Fourier analysis of multi-gated cardiac blood-pool data. Using global ventricular time-activity curves, phase angle and amplitude at fundamental frequency of left and right ventricles (LV and RV) were computed. Values of interventricular phase difference [D(phase)] and amplitude ratio of RV to LV [R(amp)] were calculated.

In 18 non-cardiac subjects, mean (±standard deviation) value of D(phase) was 1.7±5.8 degrees(d) and that of R(amp) was 0.54±0.20. In 19 patients of ventricular septal defect (VSD), D(phase) increased in proportion to the ratio of pulmonary to systemic blood flow (Qp/Qs) ($r=0.903$, $p<0.001$). Especially, those with large L-to R shunt ($Qp/Qs>2.0$) showed significant RV phase lag over 18 d. In 9 patients of patent ductus arteriosus (PDA), no RV phase delay was seen. Mean values of R(amp) were considerably decreased in cases with PDA and significantly increased in 11 patients with atrial septal defect. Values in cases with VSD, however, were distributed within normal range.

This method is highly valuable for pathophysiologic investigation and differential diagnosis of CHD with L-to R shunt.