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QUANTITATIVE EVALUATION OF ASYNCHRONIZATION OF THE LEFT VENTRICLE USING PHASE ANALYSIS.

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Clinical evaluation of regional wall motion abnormality has been performed by submitting an equilibrium gated blood pool study to a pixel by pixel temporal Fourier analysis. In an attempt to evaluate asynchronous contraction quantitatively, standard deviation (SD) of the phase distribution histogram in the left ventricle was calculated in 51 cases. In those with normal contrast ventriculography (CVG) the SD showed within 10° (6.8±1.3), while the SD in those with abnormal CVG showed higher (hypokinesis:10.2±2.0; akinesis:18.0±5.3; dyskinesis:28.3±11.8). The SD significantly correlated with the left ventricular wall motion score assessed by the CVG. It also inversely correlated with left ventricular ejection fraction (r=-0.69).

The phase analysis was utilized during nitroglycerine(NTG) and stress intervention study. The SD was markedly elevated after NTG administration in 4 of the 14 cases with myocardial infarction, while it was not changed in normal persons. During stress gated blood pool study, the SD significantly elevated in 10 of the 14 cases with angina, while unchaged in any normal person.

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PHASE ANALYSIS OF REGIONAL WALL MOTION AT REST AND DURING EXERCISE IN CORONARY ARTERY DISEASE.

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Left ventricular regional wall motion(normal, hypokinesis, akinesis and dyskinesis)was assessed by following three methods in 7 normals and 33 patients with transmural M.I. undergoing contrast ventriculography. R.I. methods were consisted of wall analysis of end-diastolic and end-systolic image, movie format, and phase analysis. Phase analysis was the most useful method among three , and its sensitivity and specificity were 88% and 86%, respectedly. Multistage supine bicycle ergometer exercise blood pool scintigraphy was performed in 10 normals and 40 patients with documented coronary artery disease. New or further regional wall motion abnormalities by phase analysis was 3(27.1%) in 1 vessel disease(OMI 11,angina 1), 9(64.3%) in 2 vessel disease(OMI 13,angina 1) and 11(84.6) in 3 vessel disease(OMI 11,angina 2). Exercise blood pool scintigraphy with phase analysis was more sensitive than exercise thallium scintigraphy or ECG. We conclude phase analysis was the most appropriate method to evaluate regional wall motion analysis both at rest and during exercise.

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PHASE ANALYSIS OF EXERCISE BLOOD POOL SCINTIGRAPHY IN PATIENTS WITH CARDIOMYOPATHY.

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The left ventricular response to multistage supine ergometer exercise was evaluated in 7 patients with hypertrophic cardiomyopathy(HCM),7 patients with hypertrophic obstructive cardiomyopathy(HOCM) and 7 normals(N). Left ventricular ejection fraction(LVEF) was caluculated as a indecx of LV global function. For evaluation of LV regional wall motion abnormalities,Fourier analysis was applied to pixel time activity curve up to third harmonics,and then cardiac functions were assessed with phase,amplitude,peak negative dv/dt,peak positive dv/dt and regional EF. In N group,LVEF increased from 62.8 per cent at rest to 77.7 per cent with exercise. Similarly,in HCM group,LVEF increased from 74.2 per cent at rest to 79.2 per cent with exercise. In contrast, in HOCM group,LVEF decreased from 75.7 per cent at rest to 70.4 per cent with exercise. No regional wall motion abnormalities were not detected in both N group and HCM group. However,in 5 of 7 patients with HOCM, exercise-induced regional wall motion abnormalities were found in high pressure chamber which seems to be main factor of decreased LVEF during exercise.

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EVALUTION OF VENTRICULAR FUNCTIONAL IMAGING BY PHASE ANALYSIS OF GATED BLOOD-POOL STUDY.

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Temporal Fourier analysis was applied to the processing of equilibrium gated blood-pool studies on a pixel-by-pixel basis, to obtain information about the pattern of ventricular(LV & RV) regional wall motion and co-ordination in normal hearts and in others with myocardial infarction and conduction abnormalities(RBBB and pacemaker implantation).

In order to evaluate them quantitatively we have constructed a distribution histogram of the LV & RV phase in radian versus activity weighted pixel and calculated the delay of phase between both ventricles.

The phase image indicated almost synchronous contruction of the both ventricles with a narrow peak in their histogram in the normal cases.

On the contrary, in the cases of myocardial infarction and conduction abnormalities, their phase image indicated regional wall motion abnormalities and asynergies with broader peak in their histogram, so that the delay of phase between two ventricles was remarkable.

In conclusion, our study indicates that cardiac functional imaging by phase analysis provides an accurate, non-invasive visual means of detecting and localizing abnormalities of ventricular contraction.