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FREQUENCY ANALYSIS OF THE BODY SURFACE POTENTIALS IN NORMAL SUBJECTS AND PATIENTS WITH MYOCARDIAL INFARCTION

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Many prior investigators reported the effect of myocardial infarction (MI) on high QRS potentials. However, in these studies, the number of recording position and division of frequency components was limited. Therefore the distribution of each frequency components was not still investigated.

For these reason, we developed a new method to analyze the distribution of frequency components over the anterior chest.

ECGs in unipolar chest lead were recorded at 36 points on the anterior chest and these ECGs were analyzed and were divided to each frequency range (30-40, 40-50, 50-60, 60-250 Hz) by means of Fast Fourier Transform (FFT) and inverse FFT. The peak-to-peak amplitude of each divided signals was measured and then contour maps were prepared by microcomputer.

In normal subjects, high band potentials were large at the fore part of the cardiac apex. In a patient with prior anterior MI, 40-50 Hz components were diminished at the central portion.

In normal subjects, the peak of each frequency waveform corresponded approximately in timing to the maximum positive or negative deflection of the original signal. On the other hand in a patient with high anterolateral MI, the peak of 40-50 Hz frequency waveform corresponded in timing to the end of the original QRS wave on the high lateral portion.

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NONINVASIVE ASSESSMENT OF LEFT VENTRICULAR EJECTION FRACTION IN PATIENTS WITH OLD ANTERIOR MYOCARDIAL INFARCTION

-EVALUATION WITH NEW MAP PARAMETERS-

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The purpose of the study was to predict non-invasively the accurate size of myocardial infarction (MI) and to evaluate the cardiac function. Subjects consisted of 60 patients with previous anterior MI with a mean age of 50.9 years. They included 11 cases with ventricular conduction disturbance (complete right bundle branch block, abnormal left axis deviation), 5 cases with marked persistent ST elevation, and 19 cases with prominent coronary T waves. For the normal control, 46 healthy subjects with a mean age of 32.5 years were used. Isopotential maps were recorded by the Mapper HPM-6500 using 87 electrodes. Map parameters used in the study were nQ40, nSubtraction30 (nSub30), Σ Subtraction30 (Σ Sub30), nSubtraction20-40 (nSub20-40), Σ Subtraction20-40 (Σ Sub20-40), nSubtraction(nSub) and

Σ Subtraction(Σ Sub) from QRS Isointegral Map and QRST Isointegral Map (I-map). These parameters were correlated with ejection fraction (EF) obtained from left ventriculography. Correlations between each map parameter and EF were as follows: nQ40(-0.35), nSub30(-0.51), Σ Sub30(-0.63), nSub20-40(-0.62), Σ Sub20-40(-0.66), QRS I-map: nSub(-0.54), Σ Sub(-0.62), QRST I-map: nSub(-0.63), Σ Sub(-0.66). Subtraction maps revealed better correlations with EF than nQ40. In cases complicated by conduction disturbances, QRS I-map showed poor correlations with EF indicating no use of this map for predicting cardiac function. On the other hand, QRST I-map showed satisfactory results for the purpose. QRST I-map underestimated EF in those cases with prominent coronary T waves, and it overestimated EF in those cases with persistent ST elevation. For the purpose of estimating EF in cases with anterior MI, various map parameters were useful, especially QRS I-subtraction map predicted EF correctly in those cases uncomplicated by ventricular conduction disturbances.

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BODY SURFACE MAPPING IN PATIENTS WITH THE HYPERTROPHY

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To evaluate the effect of the hypertrophic heart on the body surface electrocardiogram, we performed body surface mapping using a HPM 5100 system (87 lead points) in 60 patients with LVH or RVH; 23 with hypertension, 16 with AR, 15 with HCM (group A: septal thickness (ST) $\geq$ 13mm, posterior wall thickness (PWT) $\geq$ 13mm, group B: ST $\geq$ 13mm, PWT < 13mm) and 6 with primary pulmonary hypertension (PPH). From these subjects, 1) potentials at 20, 30, 40, 50 and 60 msec from the QRS onset, 2) the QRS time integral value ($\bar{A}$ QRS), and 3) ventricular activation time (VAT) were measured for each lead. The body surface distribution of abnormal positivities in sequential QRS potentials were similar among the groups of diffuse hypertrophy of the left ventricle (hypertension, AR, HCM-A). In the groups of localized hypertrophy (HCM-B, PPH), abnormal positivities of QRS potentials were found at 50, 60 msec from the QRS onset combined with the sites of hypertrophy. The abnormal positivities of $\bar{A}$ QRS which implies increase of R wave and decrease of S wave and the abnormal elongation of VAT which implies delay of intraventricular conduction were found in diffuse and localized hypertrophy in association with the sites of hypertrophy. The area size of abnormal VAT elongation on a body surface was proportional to the sum of ST and PWT in patients with hypertension and HCM, to the left ventricular internal diameter in AR patients. Thus, we concluded that the nature of the electrocardiographic change of the hypertrophic heart was increase of QRS potential and delay of intraventricular conduction.

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THE DIPOLARITY OF THE VENTRICULAR GRADIENT MAP OF ANTERIOR MYOCARDIAL INFARCTION

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